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What Modern Equipment Has Done

One of a series of articles giving the actual results achieved by replacing obsolete with up-to-date equipment

Shop No. 5

Addressograph Company

By J. P. Jackson
General Superintendent

EXPERIENCE in manufacturing parts used in the construction of Addressograph machines has shown that production increases cannot be attained by merely speeding up available equipment to turn out more work. This is chiefly because our machines are operated already at their normal rated capacity, and when such a procedure is undertaken, quality and precision are sacrificed. Therefore, since most of the parts entering into our product require extreme accuracy in construction, production demands have had to be met by the addition of modern equipment. In a good many cases, where new machinery has been installed within the past year, we have gained not only the primary purpose of cost reduction, but we have also turned out units more accurately, which, of course, adds to the quality of our product. In brief, our products consist of two classes of parts. One class is the frame, which is made up of castings, and the other class comprises the large number of smaller components assembled to the frame. The work turned out is not of the high-production type, so that our equipment as a whole must be flexible enough to handle miscellaneous operations. The savings which are quoted as made possible by the installation of modern equipment are based on the floor-to-floor time over group runs averaging from 50 to 250 pieces. Set-up times are not figured in the examples because former equipment required similar set-ups. In some cases, though, the set-up times have been reduced due to simplified tooling. The production figures show the time allowances for 100 pieces, inasmuch as our costs are based on these quantities.

Ribbon-envelope plate castings, as illustrated in Fig. 1, now are machined on a modern-type milling machine equipped with a double vertical-spindle attachment. The surfaces finished are those indicated at *X* on one side, and those at *Y* on the other side, the completion of all faces requiring two settings. When the cuts were handled singly, the operation consumed 37 hr. for 100 pieces. By using the double-spindle set-up, and in addition equipping the machine with two fixtures so that one fixture is loaded while the

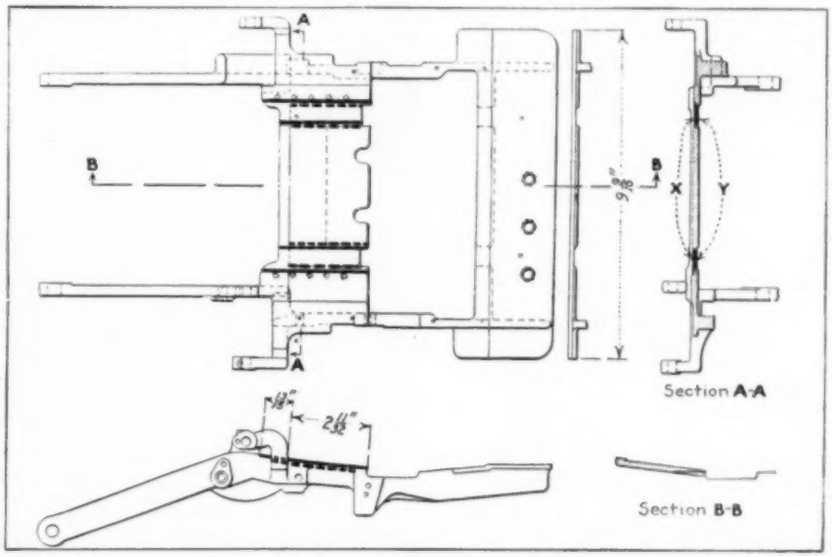


Fig. 1—Part, ribbon-envelope plate. Operation, milling surfaces X and Y. Time when milling slots singly was 22.2 min. per piece. Time with double-spindle vertical-milling head and two fixtures, 10.2 minutes

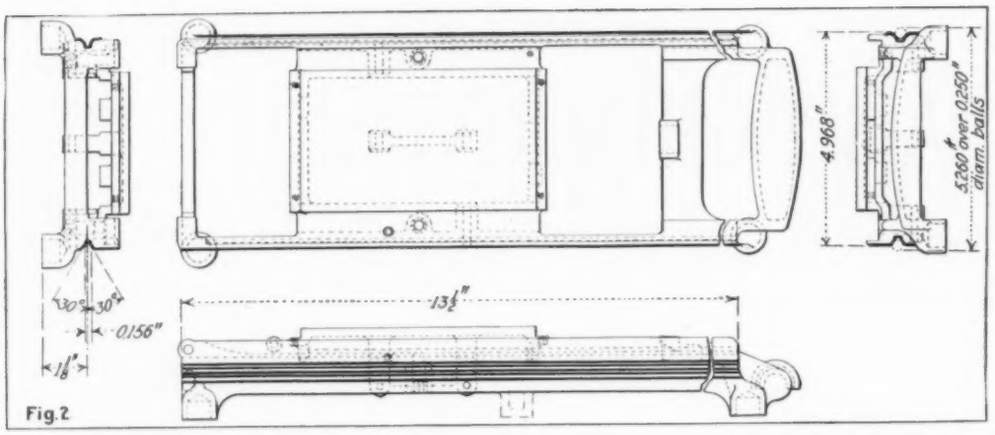


Fig.2

Fig. 2—Beds for the Cardograph machine formerly had the V-slots at opposite sides milled in two settings, the required time being 9.6 min. per piece. By performing the operation on a milling machine equipped with a double-spindle head, the time has been reduced to 5.25 min. per piece, equal to a production increase of 83 per cent

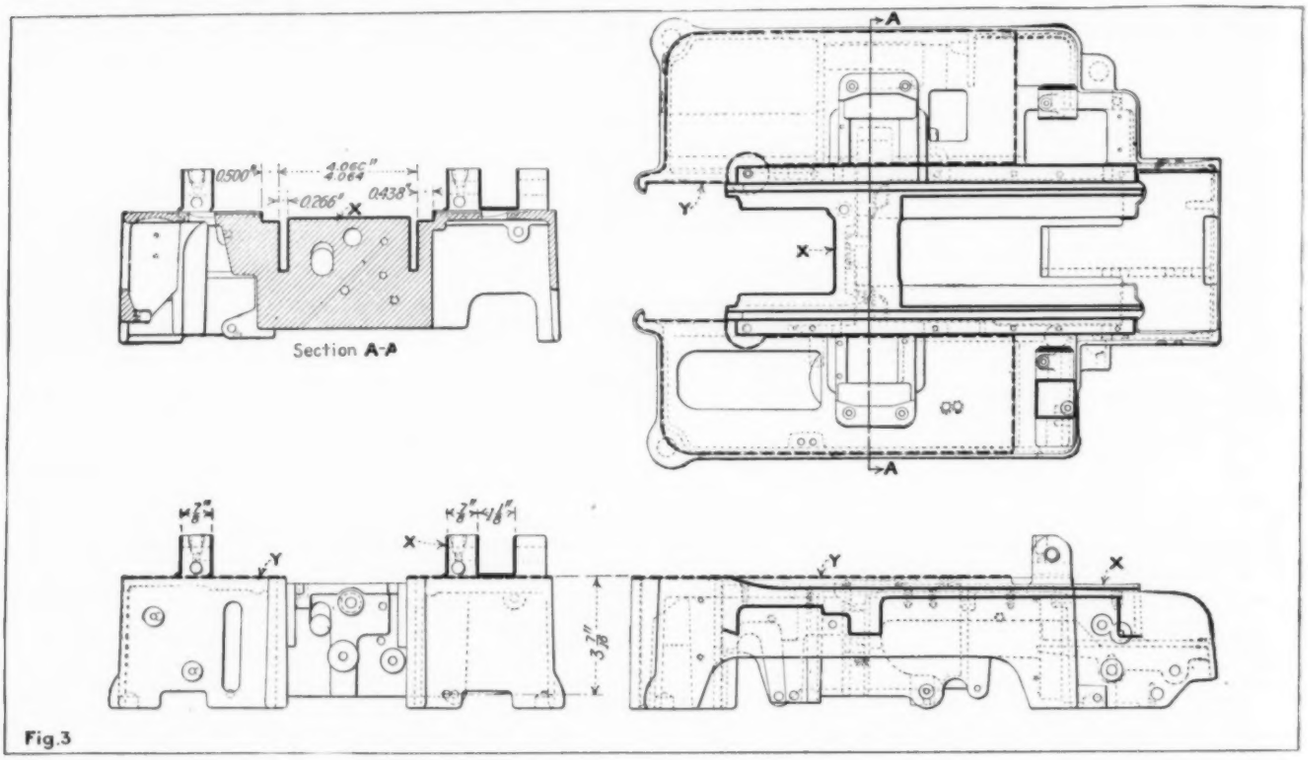


Fig.3

Fig. 3—The time per piece on surface X of this bed casting has been reduced from 15 min., an increase in production of 47 per cent. The milling time for surface Y has been reduced from 16.2 min. to 10.2 min., an output increase of 59 per cent.

Fig. 4—When the ten holes in the leg casting were drilled singly the time per piece was 3.6 min. The time using a multiple-spindle machine is 2.4 min., with an increase of 50 per cent in output

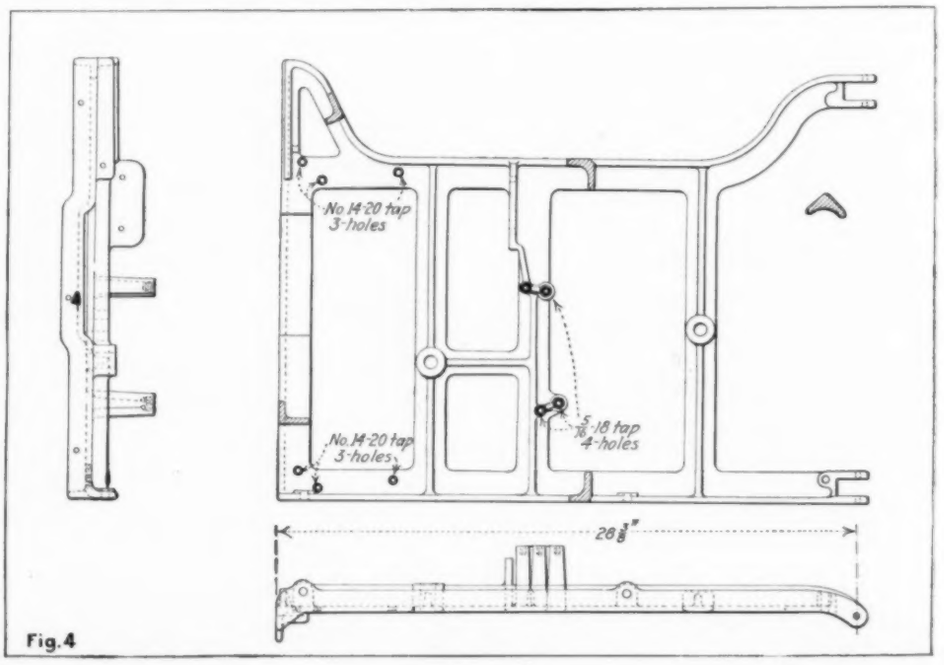
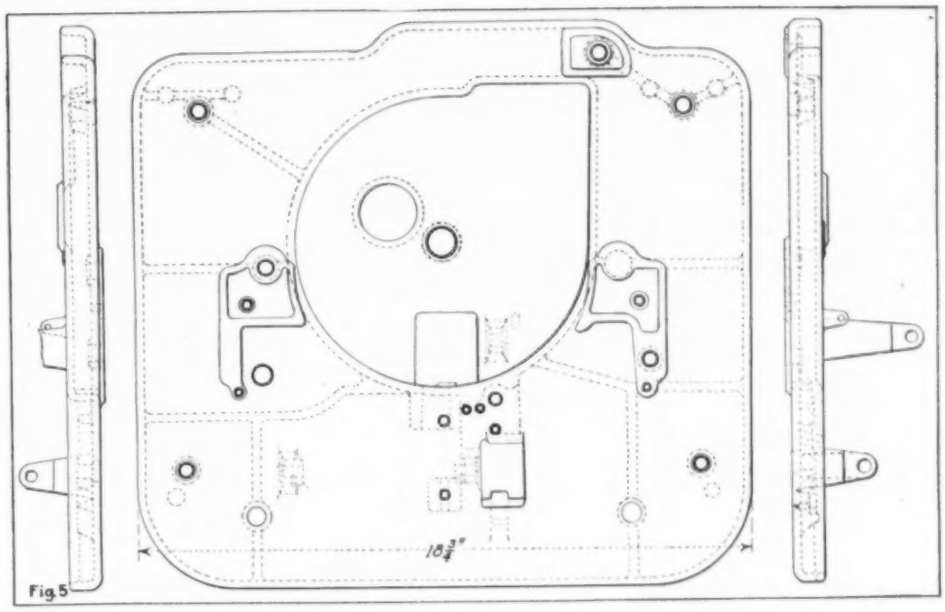


Fig.4

Fig. 5—Nineteen holes of different diameters are drilled simultaneously in this Graphotype table. The old time was 14.4 min. per piece and the new time is 4.8 min. An increase of 200 per cent in output was attained by the change



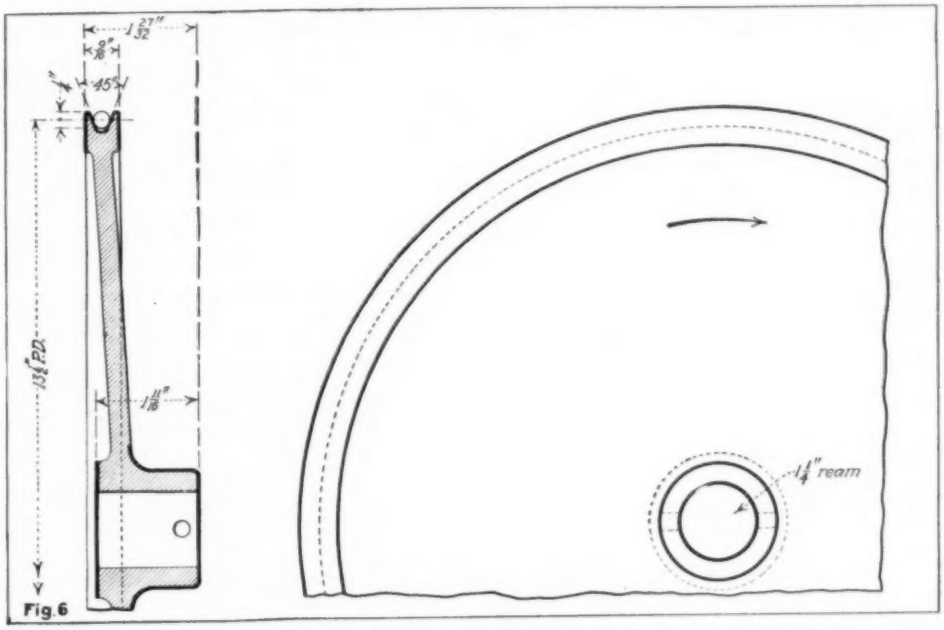
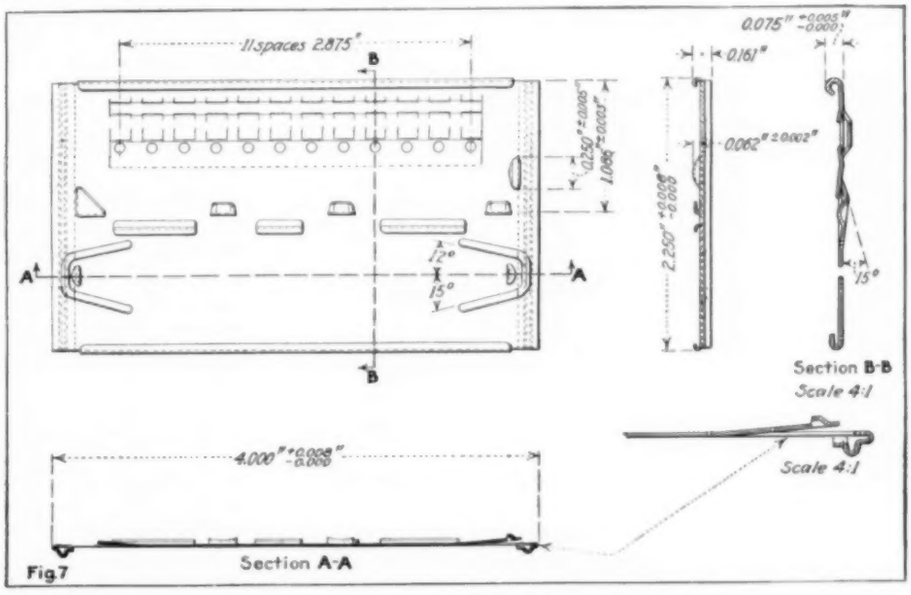


Fig. 6 — The combined operations on flywheels in engine lathes consumed 90 min. per piece, largely due to the accuracy and concentricity required. By machining in two settings in a turret-lathe, the time has been reduced to 30 min. The increased output from the modern machine is 200 per cent

Fig. 7—Formerly the forming of sheet-metal frames was done in three presses, with a combined time per piece of 0.55 min. A larger press and a three-stage progressive die has enabled the forming to be done in one pass of the machine at the rate of 0.35 min. per piece. Production increase, 57 per cent



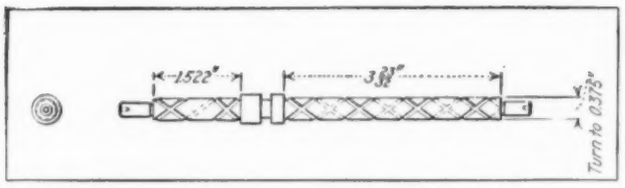


Fig. 8—When the machining of platen-roller cores was transferred from a hand screw machine to an automatic screw machine, an output increase of 178 per cent was gained. The old and the new times per piece, respectively, are 15 and 5.4 min.

other is in use, the production attained is 100 pieces in 17 hr., equivalent to an increase of 118 per cent in the output.

Cardograph-bed castings require the machining of V-slots on opposite sides as indicated in Fig. 2, their location and finish being held accurately. The operation heretofore was handled in a horizontal machine requiring two set-ups, and the production attained was 100 pieces in 16 hr. Employing the machine used for the part shown in Fig. 1, the surfaces now are finished in one cut at the rate of 100 pieces in $8\frac{3}{4}$ hr., thus increasing production 83 per cent. The new method required a redesigned fixture, since the work is finished in a horizontal position instead of being clamped vertically.

Bed castings for the Addressograph, as shown in Fig. 3, are gang milled in a horizontal milling machine at the surface *X* in one setting, and at the rate of 100 pieces in 17 hr. The same operation as formerly handled required two settings, and the output was 100 pieces in 25 hr. The increase in production is 47 per cent. In handling the work in the new machine the same fixtures are used, so that no additional tooling has been required in making the change.

Another milling operation on the same part is the surfacing of the top face *Y*, finished by an inserted-blade cutter in a vertical-type machine. As previously handled, only a single fixture was accommodated in the machine, and the output was 100 pieces in 27 hr. With a heavier-type machine and a duplex-style fixture, the operation now is completed at the rate of 100 pieces in 17 hr. The production increase in this case is 59 per cent.

While the production figures of these four milling operations may appear somewhat low, it should be remembered that the castings are thin, necessitating feeds and speeds consistent with their shape in order to prevent warpage as well as to insure maintenance of the accuracy required.

An example of a saving made by the application of a multiple-spindle drill over a single-spindle machine is shown in the Addressograph leg of Fig. 4, in which 10 holes are drilled at once at the rate of 100 pieces in 4 hr., against the former time of 100 pieces in 6 hr. The production increase is 50 per cent. These parts are run through in lots of 250, which is normally a month's production. The machine accommodates two jigs, one of which is loaded while the other one is in use.

Similar equipment is used in drilling 19 holes of various sizes in the Graphotype table, shown in Fig. 5, creating an increase of 200 per cent in production. The former time was 100 pieces in 24 hr., and the present output is 100 pieces in 8 hr. Only one jig is used, however, it being the same as utilized for the single-spindle machine. This part is run through in lots of 100 pieces.

By turning, boring, and facing flywheels, such as is shown in Fig. 6, in a turret lathe in two settings, instead of using engine lathes, a production increase of 200 per cent was obtained. The former time was 100 pieces in 150 hr., whereas the same quantity now is turned out in 50 hr., with the added advantage of maintaining more accurately finished surfaces. These figures may seem somewhat excessive, but the job in question requires extreme accuracy and concentricity.

The making of the sheet-metal frames illustrated in Fig. 7 is handled differently from the preceding examples, since the production requirement warrants the use of single-purpose machines. After being blanked, three forming operations are required which originally were performed in three presses, the combined time being 55 min. for 1,000 pieces. By installing a larger press equipped with a progressive die, the frames are made at the rate of 1,000 pieces in 35 min. The production increase on this basis is 57 per cent. The single presses ran somewhat faster than the present speed of the new press, but the older method required three operators as compared with one in the new.

Platen-roller cores, as illustrated in Fig. 8, formerly made in a hand screw machine at the rate of 100 pieces in 25 hr., now are made in an automatic screw machine

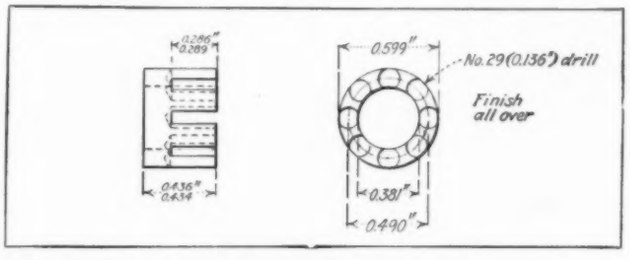


Fig. 9—Roller-bearing retainers after being turned, bored, faced and cut off in a screw machine were drilled in a jig, the combined time consumption being 2.6 min. per piece. The drill jig gave considerable trouble. By changing the operation to a modern screw machine equipped with an index-drilling attachment, the entire job is handled at one setting in 1.3 min. per piece, an increase of 95 per cent in output

with an increase in output of 178 per cent. The present time is 100 pieces in 9 hr. Cutting of the left- and right-hand helical grooves is done by a special attachment, which is responsible for the larger part of the production increase.

The roller-bearing retainer, shown in Fig. 9, was formerly turned in a hand screw machine and then finished in a drill press by drilling 8 No. 29 holes. On account of the nature of the part, considerable trouble was experienced in keeping the drill jig in operating condition, inasmuch as the jig bushings wore rapidly. The time for 100 pieces was 50 min. for turning, and 210 min. for drilling, a total of 260 min. By handling the operation in a modern automatic-screw machine, equipped with an automatic indexing attachment for drilling one hole at a time, the entire machining is completed in 80 sec. per piece, equivalent to 100 pieces in 133 min. The increased output is 95 per cent. Summarizing the savings for the ten examples illustrated, the average increase in output is 109 per cent.

Workers in highly-skilled occupations do not feel the age limit, as do those where quantity production is one of the chief requisites. The silversmiths who made the Edsel Ford airplane-trophy were men of long experience, the youngest being 65 years.

Too Much Inspection

INSPECTION is more or less of a fetish in the minds of many, while others look at it merely as a means to an end—as simply one phase of manufacturing. A follower of each faith was discussing it with a third and asking his advice as to their own plants. "What you need," said he, "is to call on Bill Holland some day. He'll set you straight." That is how the conference came about.

"We inspect after every operation, Mr. Holland," said Frank Howson. "We believe that is the only way to be dead sure of a hundred per cent perfect output."

"And is it?" asked Holland.

"You bet it isn't," spoke up Harry Howland. "Not that Frank doesn't build a good machine, but he slips up once in a while like the rest of us. We don't inspect after each operation, nor do we inspect every part a hundred per cent. But Frank will admit we build a machine that performs very well. What do you find to be usual practice, Mr. Holland?"

"There is no standard practice that I know of. I should say, however, that there is a tendency away from inspection after each operation on work where fixtures and special tooling are used. Many find that good fixtures act as inspection gages for the previous operation. Center distances of holes, for example, cannot vary appreciably if your fixtures and tools are right. Some inspect the last piece of a run to see if the fixture or tools need attention."

"But my men tell me they can't depend on tools to cut two holes exactly alike, Mr. Holland."

"If you really mean 'exactly,' I guess they are right. If you mean within a thousandth or even less, many will not agree with them. If you want duplication within a half or quarter-thousandth it means a lot of inspection. If you follow usual practice and sort out parts so as to secure just the fits you want, you save a lot of inspection and you get a perfectly satisfactory product."

"But that isn't strict interchangeability, and we are strong for that," said Howson.

"Most so-called interchangeability isn't," replied Holland, "unless the tolerances are fairly large. And few find that it pays. Most motor builders, for example, who want a definite clearance between pistons and cylinder walls, or for oil-film on the crankshaft, select pistons and bearings. Some, mighty good builders, too, say a thousandth variation, or even more, on a bearing does no harm with forced oil feed. So you see it depends on your engineers as well as on your shop practice."

"What's the objection to inspecting between operations, Mr. Holland?"

"I should say cost of the inspection, delay to work in progress, and probably a larger inventory than necessary, are the main objections. Nor is it easy to get the right kind of inspectors, Mr. Howson. Too many of them have the idea that the more work they reject the better they are."

"Well, isn't that what an inspector is for, Mr. Holland?"

"According to the notion of some of my most progressive friends, an inspector is to prevent work being spoiled, and to pass any work that will function satisfactorily for the user as well as maintain the reputation of the builder."

"That's a good one, Mr. Holland," said Howland. "I'll see if I can hammer that notion into my own inspectors. If we can make them see that it is satisfactory output and not the number of rejections, I'll be glad to boost their pay a bit."

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

Discussion

Patronizing Home Industry

The stockholders in the Hartwell Machine Company have their money in the company to pay dividends, and it is up to Mr. Hartwell to get the most for his dollar, regardless of the geograph-

ical location. A number of Chamber of Commerce members are too provincial in their ideas.

The majority of eastern railroad companies buy their valve chests and cylinder bushings from Boston, Mass., while local foundries, in some instances, are next door to the shops. A number of railroad companies some time ago bought rails from Germany because of the lower price. The railroad companies on whose lines were rolling mills also had the same opportunity, but they purchased from the home concerns because with a transportation company it is not always possible to go bargain hunting. The company is governed by the net financial results, and they have to bear in mind that a ton of steel purchased from a home concern means several tons of other commodities carried. A large amount of our national commerce is governed by just such factors as this.

—P. W. LAMSON.

Vacations, Singly or All at Once?

I believe that a vacation period with pay, set up as an incentive to those who have worked one year and established a proficiency in their work, will produce more in a fifty-week period than it would otherwise.

Most factories, as a rule, find that the summer months are not as productive of sales as the rest of the year. This is an additional reason why the shop should close for two weeks, as it will allow the production curve to be straightened out somewhat. It would also give a chance for repairing to be done and machinery to be overhauled. Where possible, these two weeks should also be made the inventory period, as the general stock is then likely to be at its lowest.

The question of a general vacation is not as important to the larger concerns as it is to the smaller. In the smaller industrial plants, where a few executives carry the detailed management, there is a let-up in production whenever one is missing, and this production does not reach its peak again for a long time after his return. For such plants, it is much better if all were to take their vacations at the same time.

—FRED A. SCHMIDT.

The idea of a group vacation is theoretically fine, but practically it would seem to depend to a great extent on the nature of the product of the plant. A plant producing an item, or rather a varied line of items that called for delivery within a few days after receiving the order, would be penalizing its customers by holding up production for a period of either one or two weeks.

The statement of Mr. Holland as to the saving effected by a group vacation would no doubt be true in the case of a sewing machine or typewriter manufacturer, where the run of production varies only in quantity, as he is easily able to govern his stock to take care of the time lost and so keep up with deliveries. At the same time, business is much more apt to reach a low level in the summer than in the winter, therefore, by spreading the vacation time over a two-month period the summer depression can be counteracted and the same force of competent help maintained.

—FRED G. WILSON.

Making Power or Buying It

John Blackington is right if he sells the old power plant and buys the power needed from the electric power companies. He is right, because he cannot invest capital for a new modern power plant, but that does not settle the matter from the general point of view. Only those things should be bought that cannot be manufactured at as small cost in one's own plant.

Supposing the works in question can employ the exhaust steam. A study should be made to see if it is possible to build a special steam production plant and buy the electric power. In other cases, where steam is not needed, a Diesel engine in connection with a dynamo would be the right arrangement. On the other hand, an isolated power plant without a complete set of machines as a reserve would be bad practice. A properly equipped power plant should consist of two complete, independent sets of machines that can be put in service by turns. The factory with its own power plant needs at least two trained electrical men, but even if the power is bought outside, an electrical man should be in every plant. Finally, in a well-managed works, the power does not need any more attendance on the part of the manager than do the other departments.

—FRANZ BERMANN, *Austria.*

Buying on Performance

That purchases of drills and of other things should be made upon a basis of performance, and not according to price alone, seems to be self-evident. But the question immediately arises, "What is performance?" There are many questions to be asked and things to be determined. A large well equipped plant will be able to answer these questions which may arise in the minds of the engineers, but for a small or medium sized plant to do so is practically impossible. Moreover, one series of tests does not answer the questions for all times, but tests will have to be made at frequent intervals, as one maker may improve the tools considerably while another may go in the opposite direction. It would seem that big concerns can purchase according to performance, but that others must weigh Mr. Holland's questions as to suitability, service and reputation, and then make the final decision according to price.

—C. J. MORRISON.

Solving a Problem with a

Pot-Type Hardening Furnace

By R. H. ARCHER

Foreman, Heat-Treating Department, The Buda Company

A furnace that increases production and decreases the amount of rejected work—Fixture makes operation continuous—Method of quenching the work

BEFORE using a pot-type furnace for hardening camshafts, these parts were heat-treated in a semi-muffle type unit. The trouble experienced with the muffle furnace was that the parts often contained soft spots, and a rejection of from 3 per cent upward was not uncommon. After experimenting considerably with various types of furnaces and carefully checking the steel used, a liquid bath was accepted as the solution of the problem. Now the rejection is far less than 1 per cent, or practically nil.

The camshafts are made of S.A.E. 1015 steel in eight sizes ranging from 30 to 48 in. in length. Prior to heat-treatment, they are copper-plated and then machined on the bearing surfaces and cam faces, as these parts only are to be hardened. The first heat-treatment is a carburizing operation, then the shafts are ready for hardening. On account of the length of the camshaft, the furnace is somewhat deeper than the usual run of equipment, and requires accurate control of the heating system to maintain a uniform temperature throughout the heating area.

A sectional view of the gas-fired furnace is illustrated in Fig. 1. The pot is 20 in. in diameter and 48 in. in depth. Five gas burners, located on each side of the outer casing, direct the flames at an angle, so that the heat will have a tendency to circulate around the pot. The draft is downward, having the air vent, or outlet, at the bottom, so that the heat will reach the top of the pot first. An additional vent is located at the top of the outer casing, but this outlet is opened only when the furnace is started after having been shut down. As soon as the liquid has reached the required temperature, the vent is plugged.

Through thermostatic control, the temperature of the carburizing solution, having a cyanide base, is maintained at 1,450 ± 7 deg. F. The heat is controlled by a butterfly valve which is automatically operated to cut off the gas when the maximum heat has been reached, or to increase its volume if the temperature falls below the low limit. The thermostat works in conjunction with a direct reading pyrometer connected to a thermo-couple in the heating bath.

The camshafts are suspended by their flanges on a spider-type revolving fixture, arranged so that the work remains vertically in the liquid. The fixture accommodates twelve units, and is suspended from an overhead shaft equipped with a swivel joint, so that it can be rotated. After a heated camshaft has been removed from the fixture, another shaft is put in its place by tongs that in turn are used to revolve the spider. The practice is to alternate the work by placing a cold camshaft alongside a heated one, so as to keep the solution at a more constant temperature. The operation is practically continuous after the first few camshafts have been heated.

An average production of 30 camshafts per hr. is attained and the time limit per piece varies from 14 to 22 min., depending upon the size of the work. The highest production by the previous method was 150 shafts in 10 hr., so that the increase with the pot unit is 100 per cent, with the added advantage of more uniform results.

An operator placing a camshaft in the furnace is shown in Fig. 2. The hood is made of $\frac{1}{8}$-in. sheet metal and surrounds the upper portion of the furnace, so as to carry off the fumes. A close view of the spider fixture is shown in Fig. 3, where several camshafts are in process of heat-treatment. The pipe at the left carries the connection for the pyrometer control.

Quenching is done in the tank illustrated in Fig. 4, which is built into the ground and is located directly in

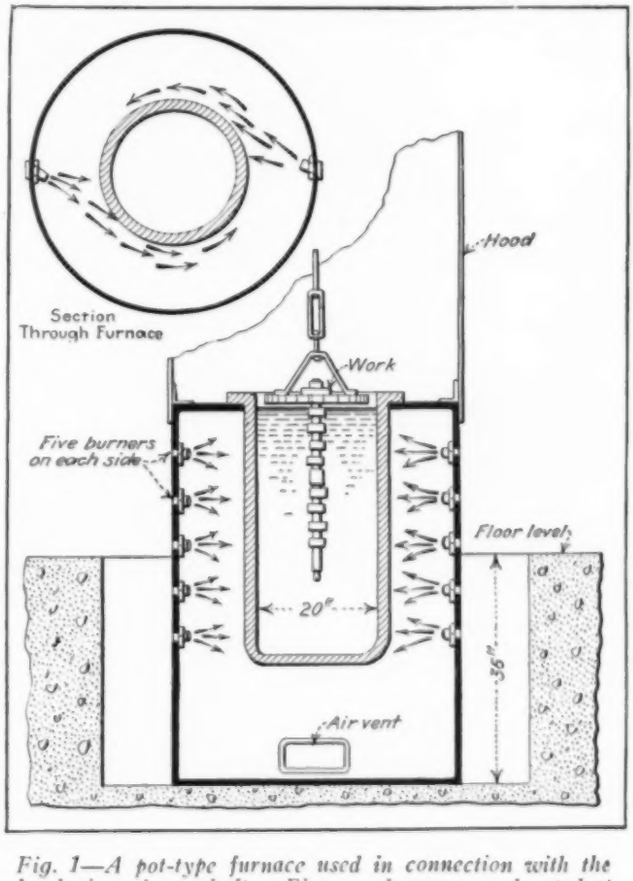


Fig. 1—A pot-type furnace used in connection with the hardening of camshafts. Five gas burners are located at each side of the outer casing, so that the heat will be distributed uniformly throughout the entire depth of the pot

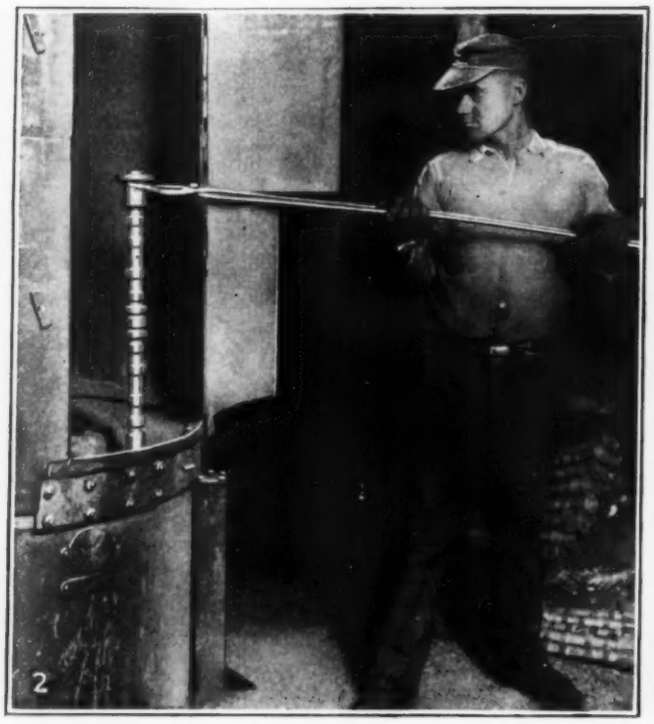


Fig. 2—Placing a camshaft in the furnace. A cyanide solution is used and the work is heated to a temperature of 1,450 deg. F. The duration of heating varies from 14 to 22 min. depending upon the size of the work.

Fig. 3—A spider-type fixture holding twelve shafts is located over the pot. In this view six shafts are shown. The operation is almost continuous, and the output is 30 camshafts per hr. At the left is the pyrometer connection

Fig. 4—Camshafts are quenched in brine that is kept in circulation. The tank is located directly in front of the furnace. The shaft is submerged with the exception of flange, and is moved about until it becomes fairly cool

front of the hardening furnace. The shafts are quenched in brine that is kept in circulation. An operator is shown placing a camshaft into the quenching bath, vertically. The shaft is dipped until the flange end only is exposed, and then is moved about freely until it has become fairly cool, after which it is placed at one side of the tank as shown at the right at *A*. One operator handles the entire heat-treating operation.

Camshafts are given scleroscope tests for hardness at each cam and at the bearings, although the tests are not made until after the hardened surfaces have been rough ground.

A similar hardening process is employed in heat-treating wristpins. The work is placed on a rod, the number of pieces varying from eight to twelve, depending upon their size. The rod is attached to the spider fixture and the same temperature and duration of heating are used as mentioned for camshafts.

Educational Advantages of Museums

"EDUCATION is not a mere accumulation of facts, but rather an understanding of the present which is born from a thorough knowledge of the past," according to a recent editorial in *The Repertory*. With this understanding it points out that practical industrial education must include information as to our industrial past, and shows that here is a great opportunity for the industrial museum to be of service.

A collection of working apparatus which shows the development of various mechanisms or processes is of great educational value for both students and adults to whom it is available. It is the belief of those responsible for the National Museum of Engineering and Industry that the parent museum should be in Washington, with branch, or affiliated, museums in the various industrial centers. It is felt that all the states would then donate their historical industrial treasures to a central museum at the national capitol and that replicas of such as seemed advisable, could be shown in the local museums. With such a national museum as a clearing house for what might be called museum extension service, a much wider distribution of such educational advantages could be obtained at a lower cost than in any other way.

Observations on English Shop Practice

By K. H. CONDIT
Editor, American Machinist

IT WILL probably be wise in commencing these observations to explain that they are not intended to represent the results of an exhaustive study of methods employed in shops all over the British Isles. In the short time available it was possible to visit only a few of the best plants in the Midlands and these, with one exception, were enjoying an unusual amount of business.

In setting down my observations I hope to be able to avoid any comparisons that will reflect on either American or English practice, but I do want to point out differences in method with the reasons, so far as they have been discovered. Rather more care in preparing for visits was taken than would have been necessary in visiting shops in the United States, but probably no more than would have been taken by an American in arranging for a trip for a foreign visitor who wanted to meet the key men in the best American plants. There is, perhaps, a little more formality in one's reception but no more delay in getting in to the man who is to be seen. Without exception I was received with the greatest courtesy by the executives, a courtesy that cannot help but make the recipient look back pleasantly on his brief acquaintance with the men involved. There may be shops in England where the reception facilities are as inadequate and the courtesy as lacking as in certain back-water shops in America, but I did not happen to visit any of them. I understand that the same courtesy is not always extended to those who want to sell goods or equipment. They apparently have much the same difficulties as their colleagues in America.

In the English machine shops these characteristics were noted: Single-story construction with a modified saw-tooth roof; absence of direct motor-drive, but well-arranged group drive; relatively few single-purpose tools; planers popular and millers scarce; turret lathes popular; no hydraulic feeds in use; materials handling not well developed, hand trucks being most popular

In shop buildings, the tendency is toward single-story construction with a saw-tooth roof. I was in several multi-storied structures not very different from corresponding buildings in the United States. The English saw-tooth roof differs from the American in that both rafters are set at the same angle to the horizontal, about 30 deg. The north side is glazed, the glass being painted to shut out direct rays of the sun. In this connection it should be remembered that England is farther north and that direct sunlight is not nearly so devastating as it is in America.

On a clear day shops of this type are very well lighted indeed, but I got the impression that illuminating engineers in England have not been so successful in introducing high intensities of artificial light as have been their American colleagues. They may have been hampered by the many different voltages and cycles provided by the English public utilities.

Brick work in the side walls of the single-story building is run higher than is customary in America, and but little clear glass is used. Those inside are apparently not expected to do any looking out, which is a great pity, because the English countryside surrounding many of the newer plants is more than charming. On the other hand it must be remembered that the workers have much more daylight in the summer after shop hours than we have. In June the sun does not set until 10 o'clock, daylight saving time, and then there is still light in the sky an hour and a half later. They pay for it in winter.

Inside the English shops the visitor familiar with the latest American practice is struck at once by the number of belts in use. Motor-driven machines are almost non-existent, except for certain specialized American tools. English machine tool builders, apparently, have given but little attention to built-in motor drives. I was told, however, that they are beginning to do so now. The millwright in an English shop is consequently an important personage. I saw well-arranged group drives and, in one shop, a complete installation of hangers fitted with anti-friction bearings.

It is only fair to remark that the delay in adopting the motor drive is partly due to the variation in voltage and cycles already mentioned. In one important manufacturing district, for example, every motor used is special. Under such conditions managers don't run wild in ordering machines with individual drives. Plenty of single-pulley drives are in evidence.

Single-purpose machines are apparently less numerous than in American shops, a condition that may be explained by the small size of the lots going through. In the one shop visited where really large quantities of small parts were in process, plenty of machinery designed and built in the plant was in use and more was under construction. Most of the jigs I saw were of the single-

unit type. Indexing and two-unit jigs are little used, and the explanation given was that the lots are too small to justify the high cost of the more complicated fixtures.

Planer-type and station-type milling machines were scarce in the shops I saw, with one exception. Planers are much more popular. In one plant I saw a double-table planer which seemed to be giving excellent satisfaction. Ninety per cent of the jobs in this shop will go on one-half of the table, which is made in two similar parts. Thus one part can be loaded or unloaded at either end of the extra length bed while the other is working. When long work must be handled the two tables are bolted together into one. It seemed to me that the gang set-ups on planer and milling machine tables were not as much used as they might have been.

Grinding Used Less Than in United States

Grinding does not seem to be as popular in England as in the United States, and honing has hardly made a start. Some automobile engine builders finish the cylinder bores with a rolling tool. In none of the shops did I see a horizontal face grinder. The process of face grinding the rough casting does not appeal to the English shop executive, apparently. On the other hand, the finishing of machine beds, tables and ways by grinding is established practice in at least one progressive plant. To make up for this elimination of hand scraping the automobile people scrape in crankshaft bearings by hand.

The art of turning has advanced to the point where the turret, or capstan lathe, as it is called in England, holds the center of the stage. This, again, is explained by the size of the lots going through. Some automatic lathes are in use, but not many. And the automatic screw machine has not replaced the hand screw machine to the extent one would expect.

Multiple-spindle drilling machines are not numerous, and those of the two- or three-way type are extremely scarce. Hydraulic feeds, for drilling machines or any other kind of machines, are looked at askance by the British machine tool builder. Since most of the users "buy British" you will hunt long before you find a hydraulically-operated unit.

Just a word about this "buy British" slogan, as long at it has been mentioned. In saying it I am paraphrasing a statement made by a British engineer—the idea is not my own. The slogan is good enough to follow when purchasing consumption goods. Buying them makes more work for British workmen and is the patriotic thing to do, provided it does not afflict the pocketbook too sorely. But when it comes to production equipment, the purchase of anything but the most highly productive type handicaps the British workman and makes it impossible for him to earn as much as he otherwise would. It may be said, further, that there is a great need in England for economic education, on depreciation and unit costs at least, just as there is in the United States. Much ancient machinery would be melted up if owners could be convinced as to just what it is costing them.

In the forge shop, British engineers show a strong preference for the belt drop hammer. Steam hammers are used, of course, but I did not see a single board drop and but few helve hammers. The reason for the preference was not forthcoming.

Gas was preferred for heat-treating and hardening in most of the shops I visited, electric heat being considered too expensive. At least one good installation of electric furnaces has been made and others are coming. Little automatic handling was in evidence.

In the plating room, practice is apparently standardized on rack dipping, everything being done by hand. I saw no plating barrels nor any automatic handling equipment. Punch presses are guarded by sliding or pivoted gates, but belts are left much freer than would be permitted by an American insurance factory inspector. Perhaps after one look at the forest of belts in the average shop the safety legislators gave it up in discouragement, or concluded that there would be more protective than productive equipment if everything were fully guarded.

Progressive dies are but little used, expense and small runs being given as the reason once more. Hand presses of the screw type, operated by a handle and weighted wheel, are used to a considerable extent, many of them by women operators.

Material Handling not Advanced

Most of the material handling seems to consist of loading one or more pieces on a four-wheeled truck and pushing them to their destination. There are chain conveyors and roller conveyors in use in the most advanced works, but inter-machine transportation has seemingly been given but little attention. A few electric trucks were in evidence, and one plant I visited was well equipped with standard containers and platforms for use with hand-lift or electric trucks. Jib and wall cranes are more generally used than is the case in America, monorails and traveling cranes not so much.

More women are employed, particularly on heavy capstan lathes, than would be found in corresponding American shops.

It is permissible to employ children at the age of 14. The sight of them running errands about the shop or tending simple machines is something of a shock to American eyes.

These observations, since they were made in a few of the best English shops, probably picture practice considerably above the average.

What Constitutes Proper Inspection?

Is inspection a post-mortem examination? Is the inspector a policeman whose record stands on the number of offenders he finds? Is inspection a production, engineering, or management operation? These are only three of a number of live questions on mass production inspection that will be discussed in a series of articles on automotive inspection methods to appear shortly.

Equipment Makes Possible the Ford Model A

Assembly of the Motor

By Fay Leone Faurote, M.E.

MOTOR assembly is one of the interesting points in the production line, particularly where new designs and methods are involved, as in this case. Those who have followed the preceding articles and noted both the drastic changes in design and the enormous expenditures for equipment, will find the illustrations showing the assembly of various units and of the complete motor of special interest. Operation sheets and details have shown not only the construction of the new motor, but also the care taken to maintain extremely close tolerances in the essential dimensions. The cylinder block and the cylinder head are worthy of careful study. Both the piston and the piston-pin are new in the Ford construction. The former is of the aluminum, split-skirt type, and the latter is a product of the extrusion process, on a punch press of heavy construction, after which it is finished all over and ground on a special Ford centerless machine. It is carbonized about 0.03 in. deep, on an average, normalized, and hardened. The finished pin must stand 9,000 lb. pressure in the center when supported in a cup at each end.

Another unusual practice is the forging of the connecting rod bolts that hold the cap, integral with the rod itself. The motor assembly is an excellent example of the use of conveyors, each carefully selected for the particular work it is to handle. The method by which parts are always within reach of the operator, and yet not piled on the floor and so taking up valuable room, has the additional advantage of reducing the total quantity in process by avoiding large stores at various points. The cost of operating a huge stockroom, not forgetting the valuable space it occupies and the cost of handling large quantities of material in and out of it, are largely eliminated. Clerical labor is reduced to

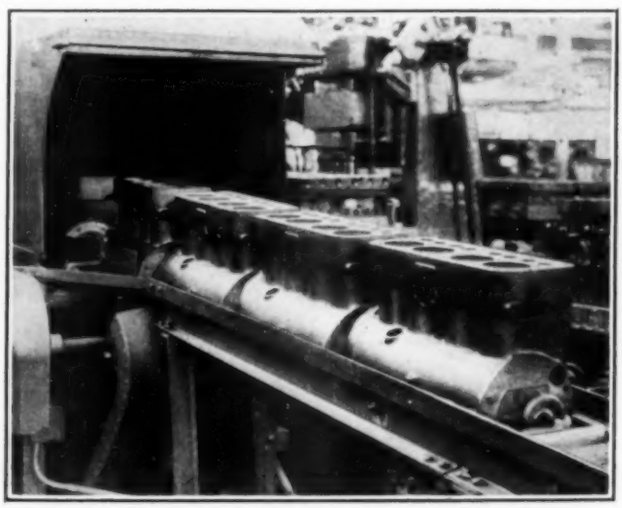
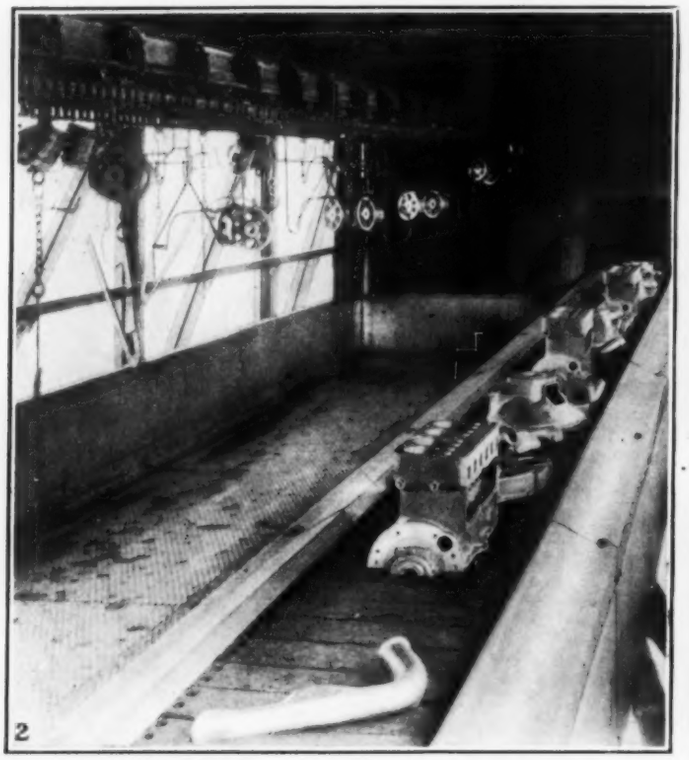


Fig. 1—Cylinder blocks coming from the washing machine on their way to the motor assembly. Washing machines have come to be a part of the production lines in many shops. They not only save time and disagreeable work, but insure uniformly clean parts for assembly



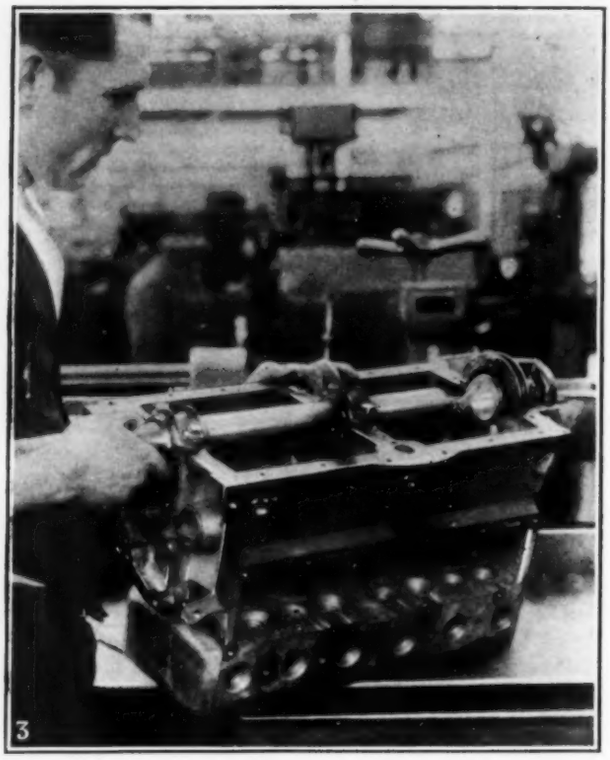


Fig. 2—Two types of conveyors employed in bringing finished parts to be used in sub- or final assemblies. The overhead carrier at the left is provided with hooks of various kinds to accommodate small parts, while larger parts are carried on the wood-slat conveyor, which is provided with substantial guards at each side. Fig. 3—Checking the alignment of main, or crankshaft, bearings. The test bar fits two of the shaft bearings and carries a sensitive indicator at the end. Turning the bar in the two bearings shows any deviation from alignment in the third bearing

a minimum, as the parts are checked from the production lines directly to assembly.

Sub-assemblies are also important. It is necessary to have them ready on time, and also to see that they are fed into the final assembly line at the proper point. Good examples of this are seen in the two pumps that handle the water circulation and the lubricating oil, respectively. The transmission unit also joins the motor and becomes a part of it as it passes down the line on its way to the test stand, and toward mounting in the chassis.

Engine Assembly Operation Sheet

No.	Operation	Machine	No. per Hour
1	Straddle mill main bearing (rear), mill oil pocket in all main bearings after babbitting	No. 5 Hendey mill, power feed	100
2	Cut valve seats	No. 15½ Foote-Burt 8-spindle drill, hand feed	80
3	Inspect valve seats and top of cylinder block	Hand operation	...
4	Wash	No. 80-P Blakeslee washer	1,500
5	Assemble eight valves, eight valve-guide bushings, and grind valve seats in cylinder block	8-spindle Foote-Burt oscillating valve-grinder	25
6	Clean valves, bushings, valve seats, port holes and holes for bushings	Hand operation	...

Engine Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
7	Assemble eight valves, eight valve-guide bushings, eight valve springs, and eight valve-spring retainers to cylinder block	Hand operation	...
8	Inspect valve assembly and main bearing babbitt	Hand operation	...
9	Assemble crankshaft rear-bearing seal	Hand operation	...
10	Assemble one crankshaft rear bearing cap (with one welsh plug assembled), two crankshaft bearing caps, two rear bearing, four front and center bearing. Put in temporary liners	Hand operation	...
11	Line-bore main bearing babbitt	Reed-Prentice double-end lathe, power feed	38
12	Ream 0.436/0.4365-in. and counterbore 0.468-9-in. dowel-pin holes for locating flywheel housing	Ford machine for reaming two 0.436-in. transmission locating holes	100
13	Cut radius in main bearings	Ford radius machine	120
14	Disassemble, operation No. 10	Hand operation	...
15	Cut oil groove in main bearings	Ford machine for oil grooving main bearings	300

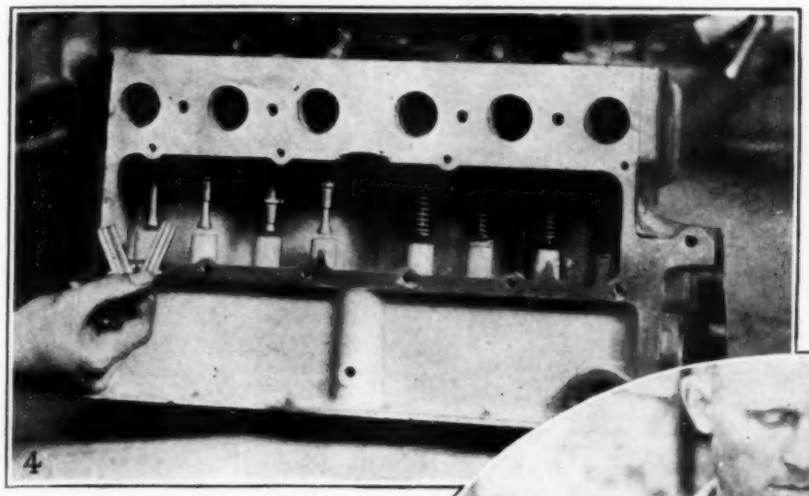


Fig. 4—Assembling valves, valve-stem guides and valve springs. The valve stems have enlarged ends, or mushrooms, to increase the area of the wearing surface. This necessitates using a split guide as seen at the left. Three of the guides are in position ready to be forced into place. The valve springs are in place at the right

Fig. 5 — Assembling crankshaft to engine block. This view shows the size of the bearings, the turned crank-cheeks and the oil retaining grooves at the left. The four turned disks act as counterbalance weights to insure smooth running. The block is moved by a dog between the raised sides of the conveyor

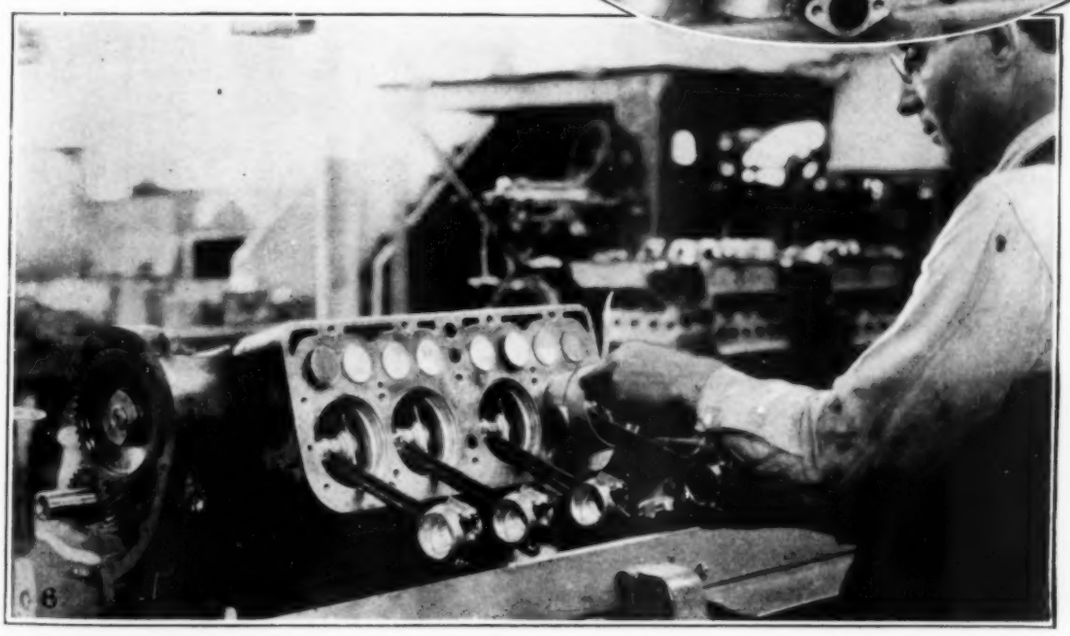


Fig. 6—Checking the clearance between pistons and cylinder walls by means of a sheet-metal feeler. A clearance of from 0.002 to 0.004 in. is permitted. Each piston is checked and selected to give the desired clearance within the tolerance allowed

Fig. 7 — Assembling piston rings to pistons with pistons in cylinder blocks, but before connecting rods have been attached to the crankshaft. The device shown spreads the ends of the rings sufficiently to pass them over the head, but the side arms prevent expanding the rings enough to damage them

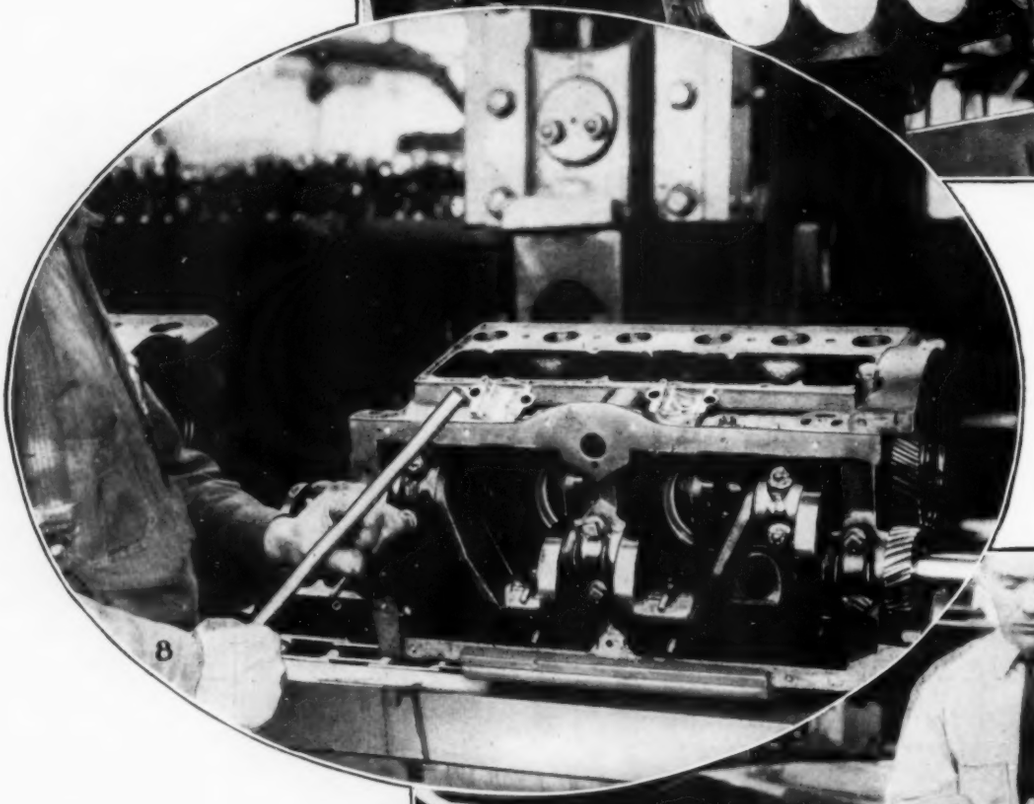


Fig. 9 — Attaching the intake and exhaust manifolds. This view shows the compactness of the modern engine and the way in which the carrier, or truck, is designed to hold it in various positions for different assemblies

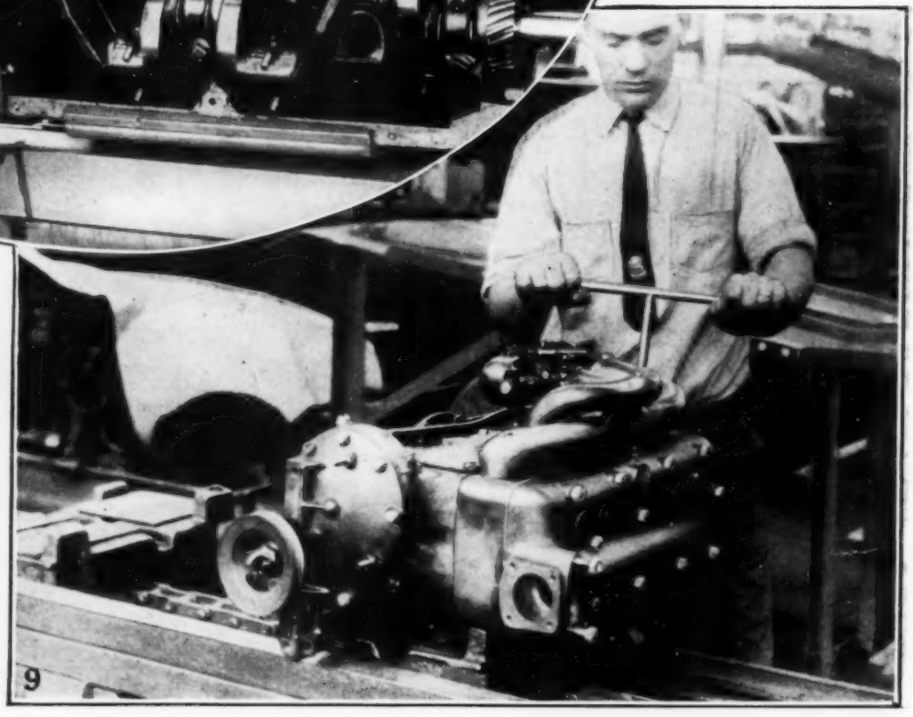


Fig. 8—Assembling the connecting rods to the crankshaft. The bolts are an integral part of the connecting rods. The bearing caps are put in place and cottered in the usual manner, using a socket wrench. In this assembly the engine is on the usual chain conveyor

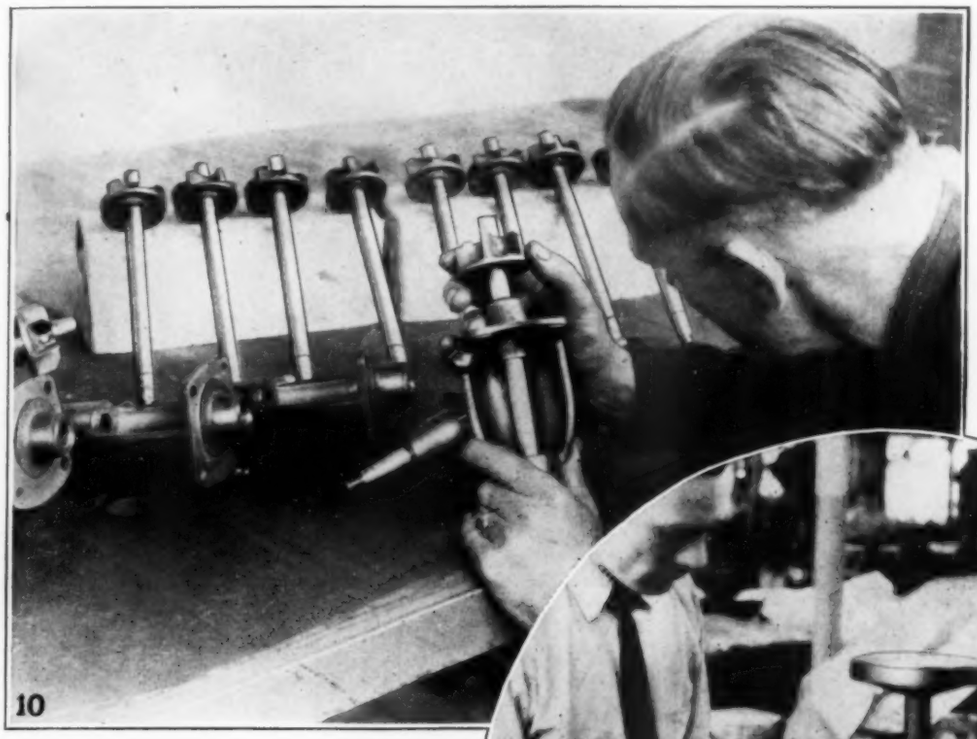
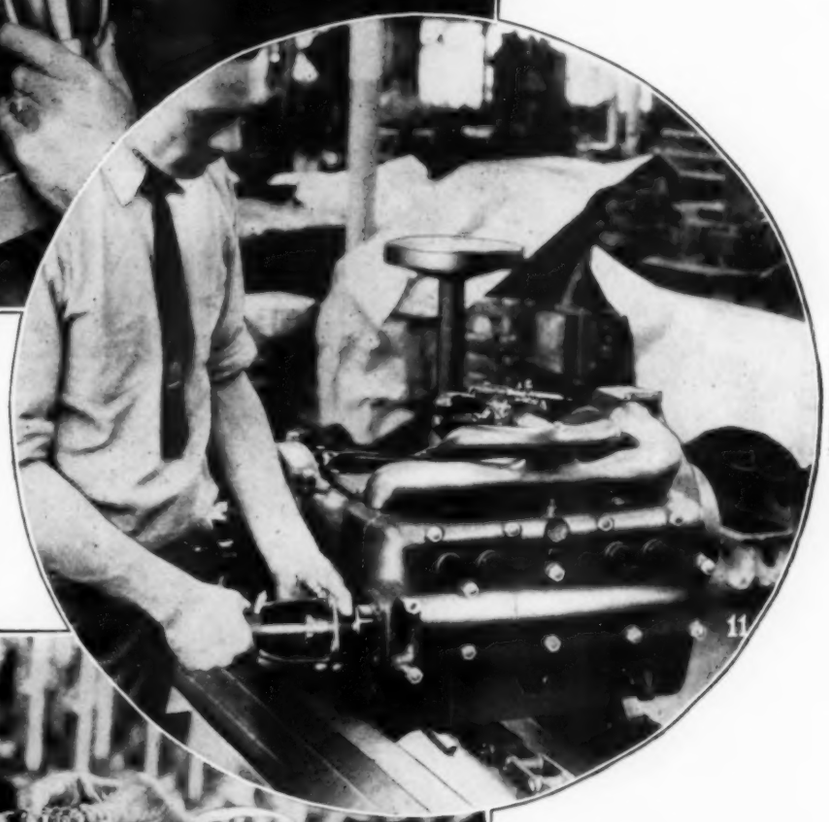


Fig. 10 — Assembling the water pump. One of the sub-assemblies that afterwards feeds into the final assembly line at the proper point. It is attached to the front of the cylinder head, at the end of the water passage

Fig. 11 — Putting the water pump in place. The water-pump unit is complete in itself and is attached to the front end of the cylinder head, so that the impeller is in the water passage



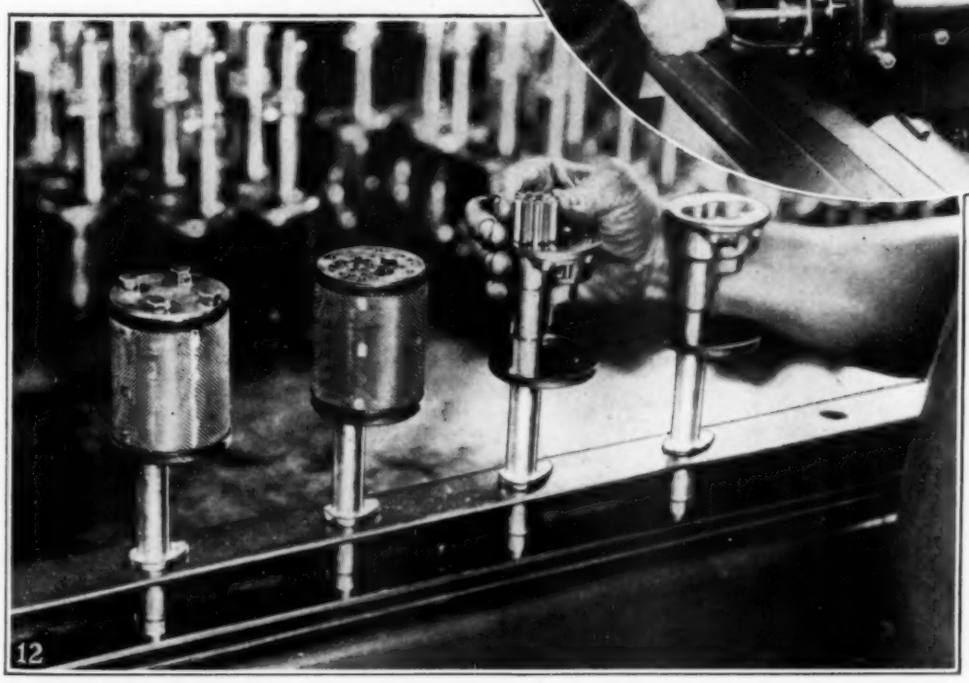


Fig. 12 — Four stages of assembling the oil pump. Beginning with the body, or case, at the right, the pump gears are assembled, the screen put around the outside, and finally the cover, or end plate, is put on

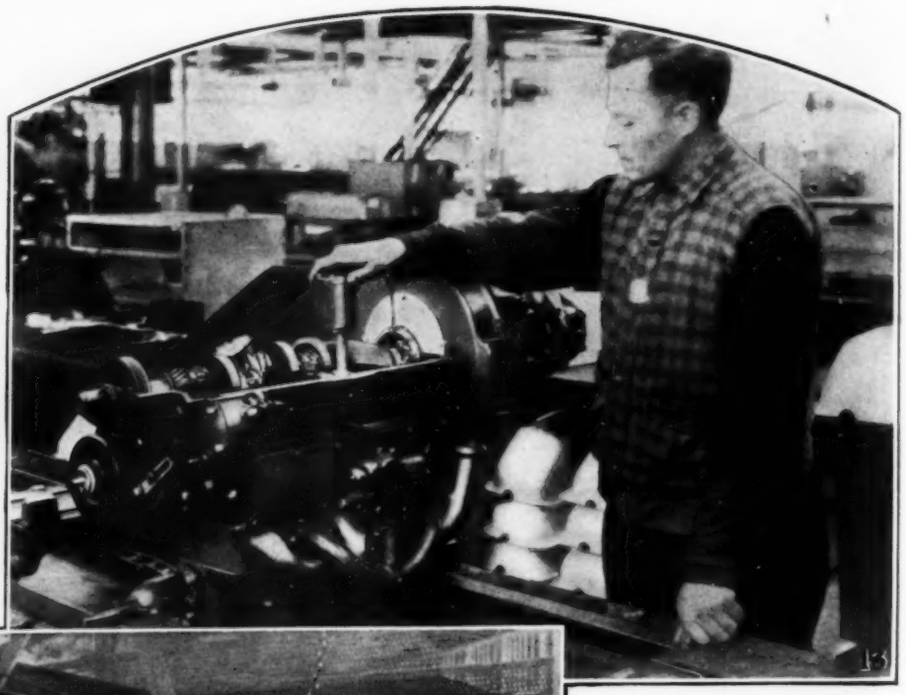


Fig. 13 — Assembling oil pump to engine. The pump is located by a dowel which also prevents it from turning. This view shows the generator and water pump in position, and how the manifolds are held in place. The same conveyor truck carries the engine in the inverted position

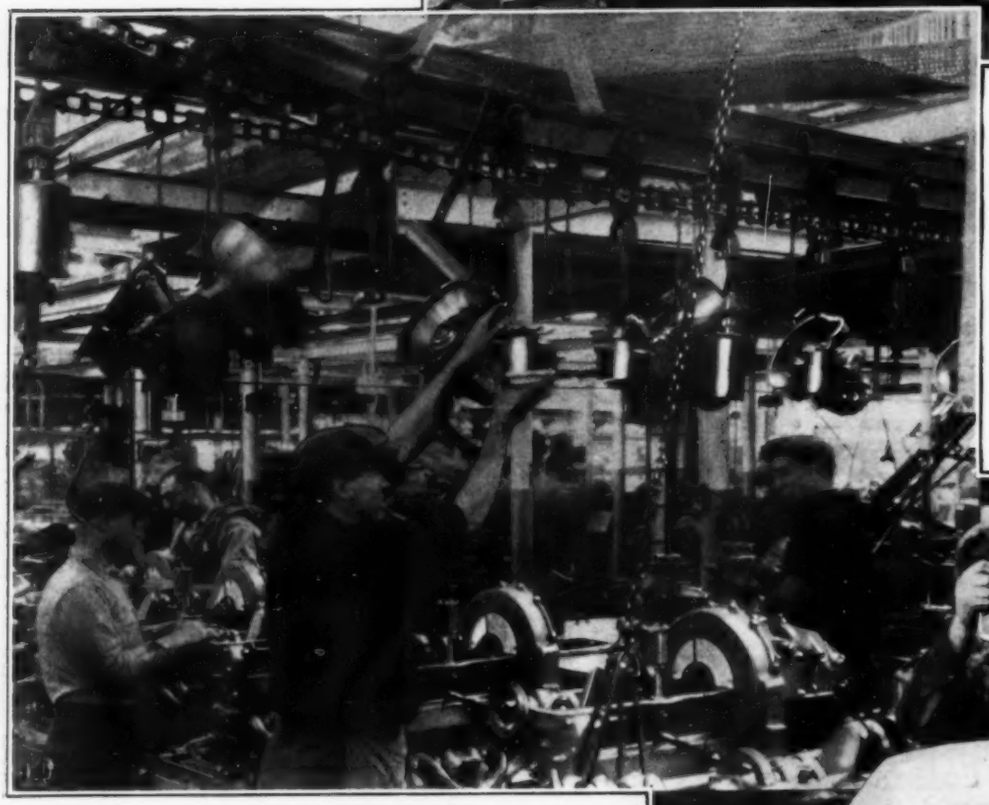


Fig. 15 — Fastening the oil pan in position on the block after the oil pump has been put in place. The engine is now practically complete and ready for its final test before assembling to the chassis

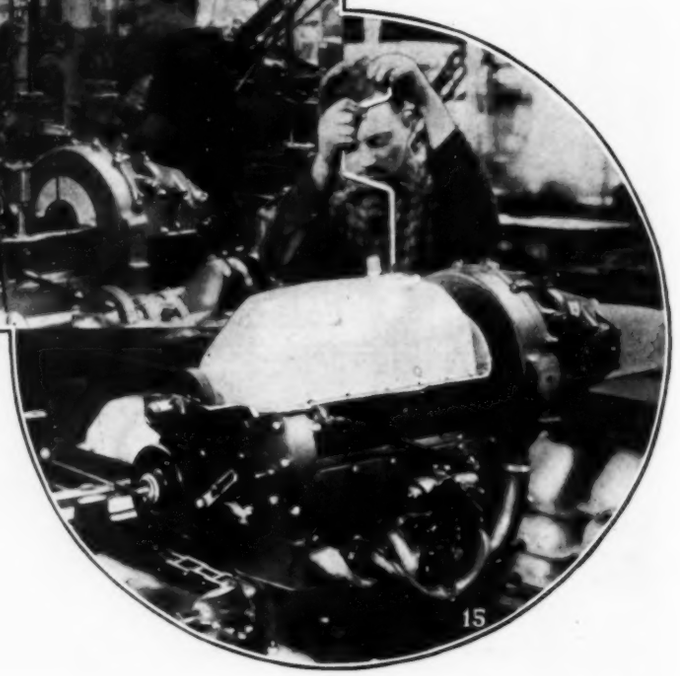


Fig. 14—Conveyor above assembly line. The parts needed at various points in the assembly are brought to the men. As shown, a generator is being taken from the conveyor. In the same way starting motors, and transmission cases are always ready as needed. Material is always at hand without being carried, and no floor space is taken up by storage

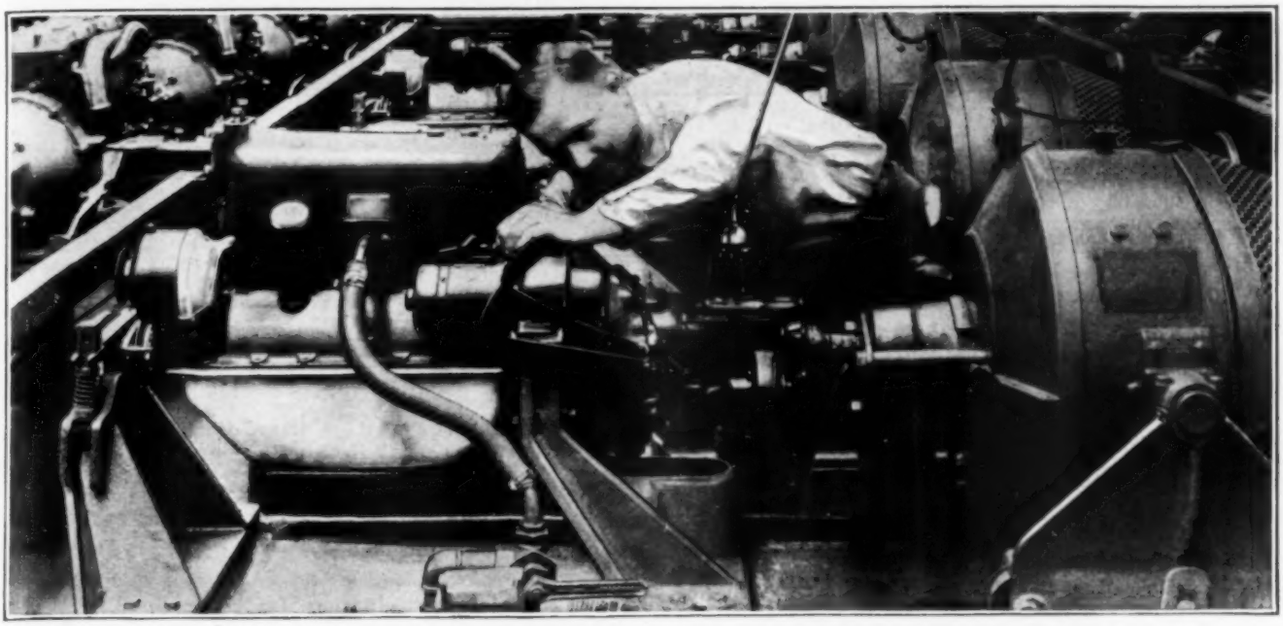


Fig. 17—Engine test room. Every engine is tested under its own power, using a generator as a test load. As shown, the transmission and clutch are being tested for noise. Quick-acting clamps hold the engines in place

Engine Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
16-A	Cut oil grooves in rear bearing cap and front and center bearings	No. 40 Bliss press (1) 18z-1203 machine to cut all oil grooves in main-bearing caps. Will obsolete operation 17	750 210
16-B	Cut oil grooves in front and center bearing caps (two at a time)	No. 40 Bliss press	750
17	Reassemble operation No. 10 with one crankshaft assembly. Using four liners and two front, center and rear bearing liners in place of temporary liners	Hand operation	...
18	Burnish crankshaft bearings	Ford running-in stand	40
19	Disassemble operation No. 18. Inspect babbitt and reassemble with eight front and center liners, four liners and six cotter pins	Hand operation	...
20	Raise valves, air clean port holes, clean and oil push rod holes.	Hand operation	...
21	Assemble eight push rods	Hand operation	...
22	Assemble one camshaft assembly	Hand operation	...
23	Release valves, inspect push rod and camshaft assembly	Hand operation	...
24	Assemble one timing-gear side cover, one gasket, two cap screws and two washers	Hand operation	...
25	Clean cylinder bore and pin bearings	Hand operation	...
26	Inspect pin bearings	Hand operation	

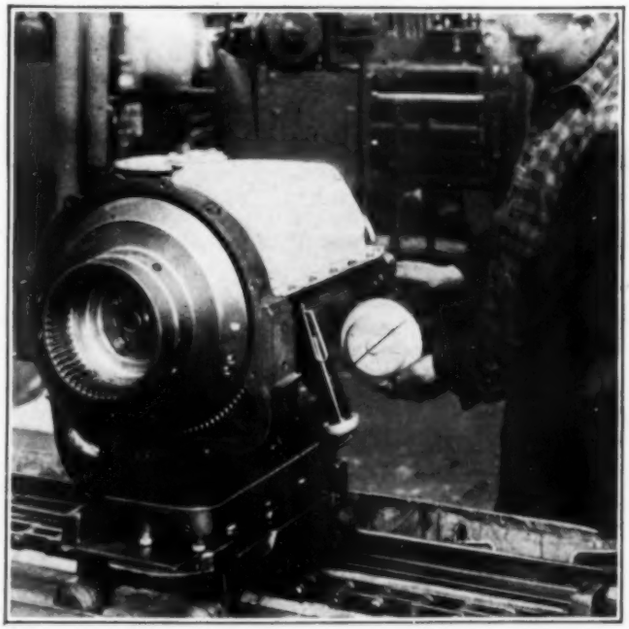


Fig. 16—Mounting the generator on the engine block. The generator is unusually large in diameter and is held in place by a steel strap that goes around the outside, but can easily be taken off for removal or replacement

27	Fit four pistons with piston pin, piston-pin retainer, connecting rod, connecting-rod cap and nuts, assembled to cylinder bores	Hand operation	...
28	Stamp cylinder number on piston; connecting rod and connecting-rod cap, remove nuts and connecting-rod caps	Ford nut driver No. 3 Greenard arbor press	200 100

Engine Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
29	Assemble four pistons with four piston pins, four piston-pin retainers, twelve piston rings, four connecting rods, four connecting-rod caps and eight connecting - rod nuts	Hand operation	...
30	Oil connecting-rod bearings	Ford running-in stand	40
31	Time valves	Ford timing machines	8
32	Clean and inspect inner lower half of cylinder block	Hand operation	...
33	Assemble one rear bearing-cap oil pipe to rear bearing cap	Type WD-300-A General Electric arc welder	...
34	Assemble two and eleven cylinder head studs to cylinder block	Hand operation	...
35	Assemble four manifold studs to cylinder block	Hand operation	...
36	Assemble one cylinder head with one water pump, one gasket, four studs, four washers and four nuts assembled; one distributor setscrew, one nut, four false spark plugs, one gasket, thirteen nuts and one plug (wood) in distributor hole	Hand operation	...
37	Assemble one oil-pump drive-gear assembly and one oil-pump drive-gear bearing retaining-spring	Hand operation	...
38	Assemble one valve-chamber cover, one gasket, ten capscrews and ten washers	Hand operation	...
39	Assemble one front-end cover, one gasket, six screws, seven washers, one timing pin, one washer, one generator-bracket screw, one crankshaft oil-slinger, one crankshaft pulley, one crankshaft ratchet, one pan and cylinder front-cover packing, one camshaft thrust - plunger, spring and one camshaft thrust plunger	Hand operation	...
40	Disassemble eight connecting-rod nuts, four connecting - rod caps. Reassemble with eight connecting-rod shims and and cotter pins	Hand operation	...
41	Assemble one flywheel housing, one gasket, two flywheel-housing dowels, six capscrews, two washers, one brass lock-wire, one flywheel - housing shield, one capscrew, one washer and one cotter pin	Hand operation	...
42	Inspect. Indicate O. D. and face on flywheel housing	Hand operation	...
43	Assemble two dowel pins, one flywheel assembly, four capscrews, one clutch-pilot bearing, one clutch pilot-bearing felt, one clutch pilot-bearing felt retainer, one brass lock wire	Hand operation	...
44	Inspect, indicate O. D. and face on flywheel	Hand operation	...
45	Assemble one oil return-pipe assembly, two gaskets, two gaskets and two screws	Hand operation	...
46	Assemble one intake manifold, one exhaust manifold, two screws, two washers, four clamps, four nuts, six gaskets, and six manifold glands	Hand operation	...
47	Invert motor	Hand operation	...
48	Assemble one each right and left oil-pan gaskets and one oil-pan packing (rear) cork	Hand operation	...
49	Assemble one oil-pump assembly and one set-screw to cylinder block	Hand operation	...
50	Assemble one clutch-housing hand hole cover, two screws to transmission assembly	Hand operation	...
51	Assemble transmission assembly, eleven cap-screws, lock washers	Hand operation	...
52	Assemble starting motor and drive assembly, three capscrews, three lock washers	Hand operation	...
53	Assemble one oil filler-pipe and one oil filler-cap assembly	Hand operation	...
54	Finish assemble flywheel-housing shield, two screws and two lock washers	Hand operation	...
55	Pour five quarts of oil in motor	Hand operation	...
56	Pour one pint of oil in transmission	Hand operation	...
57	Assemble one oil pan-assembly with oil pan-cleanout plate, one gasket, six screws, six washers, one plug, one gasket, and one oil pan and cylinder front-cover packing assembled, twenty screws, twenty washers and one oil pump-retaining spring	Hand operation	...
58	Assemble one oil gage	Hand operation	...
59	Assemble one generator assembly, one hinge bolt, one lock washer, one nut, one generator-adjusting arm, one lock washer, one screw, one lock washer and one nut	Hand operation	...
60	Assemble one trunnion, two cap screws	Hand operation	...
61	Revert motor	Hand operation	...
62	Assemble one cylinder head stud and one nut	Hand operation	...
63	Water test	Hand operation	...
64	Block test	Running-in stands	2
65	Tighten cylinder - head nuts and drain oil	Hand operation	...
66	Stamp serial number	Hand operation	...

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Standards for Machine Finishes

"SAY, Al, Williams must be using you as a first-class messenger boy. I see you were off on another trip. What was the idea this time?"

"Well, it was a legitimate trip, all right. The sales department called for someone to go up to the Hurley Machine Tool Company and adjust that machine we sold them, so Williams thought I ought to go, and at the same time see if I could pick up any new pointers on shop work."

"Did you get anything new, Al?"

"Yes, one good point, I think, Ed, that we might be able to apply. In their time-study department they have a museum display of finishes for various kinds of metals, and to suit different service conditions. The designer calls for a definite kind of finish on the drawings, and if there is any question about what the shop is producing, a comparison is made with the sample in the time-study department."

"What good does that do? Don't the foremen know good finishes when they see them?"

"True, Ed, but what's the use of paying for a high-class finish if it's not needed? If there are standards to work to, the foreman can see that his men are not spending time on extra cuts to produce fine work where tool marks on the piece will not do any harm. On the other hand, where extra nice finishes are required, the time-study fellows usually know the short cuts to get the finish, because they're around studying the methods of all the men. The Hurley shop finds that the mechanics as well as the foremen like to go in and study over the samples and get the pointers on how to produce the finishes—speeds, feeds, grinding tools, and so on.

"They have a lot of plates and blocks of different kinds of metals planed to the various kinds of finishes, also round samples turned in the lathe and turret machines. They are all set out on special tables for the purpose. I like the idea, Ed."

"It might work all right in one shop, Al, but I don't believe we ought to be telling the good mechanics what finish they must use on a piece of work."

"I rather disagree, Ed. Isn't it just as important to indicate a finish as a dimension?"

How do the machinists judge the finish to be put on the work? Should every shop have a set of standards for machine work? Or, should it be left to the judgment of the workmen and inspectors?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Monthly Checks on Workmen's Ability

IF PROPERLY reduced in the number of items, these monthly check-up cards ought to be a good thing. The number of items might be reduced to about four—initiative, quality, quantity, and adaptability.

Sometimes a man will be lucky enough to draw jobs on which the attention of the management is focused, so that his good work will stand out to the disadvantage of a man doing better, or equally as good, on jobs which are not in the limelight. Monthly cards tend to correct these impressions and give credit where credit is due, regardless of the publicity attending the job.

—Jas. F. Fitzgerald.

Do Brains or Beef Count Most?

A FOREMAN is selected because of his initiative as well as his ability to outline without hesitation the most adaptable, feasible or practical method of dispensing with a critical situation. However, perfect physical health is essential. Otherwise there are possibilities that the mental powers will not function perfectly. When the incapacitation of the foreman becomes detrimental to the manufacturer, he should be released from further service for the welfare of the firm.

—Wilbur S. Austin.

How Much to Spend for Repairs?

THE question of repair versus buying falls properly under the control of the maintenance department, rather than under the foremen. In this way the decision can be made on the basis of established facts rather than individual preferences. After a study in which the age of the machine, previous repairs, and improvements in new machines have been considered, it will not be a case of favoring a machine because the individual foreman has been particularly sold on that machine.

—James P. Keating.

He Never Asks for a Raise

THE psychological effect is lost when a raise has to be asked for. Therefore, it is Ed's duty to attempt to increase any of his good workmen so that in the event of refusal he cannot be held responsible.

Many men feel that if they apply for a raise and it is refused, they are showing a lack of independence unless they leave immediately. Therefore, men are backward in indicating their desire for an increase unless they are prepared to leave. Why should raises be given only when expected or asked for? A surprise in the pay envelope has a lasting tonic effect.

—J. C. Gilston, *Scotland.*

THE · NEXT · TOPIC

Wear Goggles or Quit

ADVANCE QUESTION

Williams has posted a notice that any man not wearing goggles when grinding must hunt another job. Ed feels it's a question of personal liberty and objects. What do you think?

Putting Color on the Machinery

SINCE colors appeal to the senses, and since nervous cases can be assisted by cheerful surroundings, it seems reasonable that colors should assist shop morale. Then comes the snag. Who is to detail the scheme, and what is his taste? If the colors chosen offend taste, then morale will suffer. Since tastes differ so widely, the problem is not a simple one.

—A. Graham, *England.*

Helping the Efficiency Engineer

IT IS logical to suppose that the man who devotes his entire time to one branch of a profession should become more proficient than the man whose time is divided among several branches. However, it is sometimes the case that the highly-paid advice obtained from the efficiency engineer could be obtained from the regular employee. Executives should realize that practical experience has its value, and that many problems could be solved by the man in the shop without securing advice from one who is loaded with theories but lacks the practical experience necessary to make the theories of value.

—J. Binder.

THE purpose of the efficiency engineer is not to show men who have spent years on the job where they are all wrong. What should appeal to Ed, whose experience has necessarily been confined to his own line, is that the new man comes in with a new perspective, and with knowledge gained from many shops. If Ed puts his problems up to the efficiency man, the latter may be able to suggest ways and means of solving them. In any event, it will do no harm to talk them over with the newcomer. If Ed adopts a "hands off" policy, he may miss a few pointers.

—H. C. Kline.

Heavy Contract Work in a Southern Shop

Wherever mills concentrate there is likely to be a great variety of machine work that can best be done locally—Some of the big jobs handled by a shop in a mill section

AT THE plant of the Birmingham Machine and Foundry Company, the machinery building and contract work is in a building apart from the pipe founding and other activities of the company. The casting of machine parts is also taken care of by a separate foundry which is a part of the shop organization, and is located at one end of the shop building. This building is 100 by 475 ft., of which 200 ft. of the length is given over to the machine shop and 275 ft. to the foundry. A wing, having a floor area of 75 x 75 ft., located at one side between the foundry and the machine shop, is devoted to boxing, packing and loading, and railway sidings enter this wing of the building. An average of 75 men are employed in the shop, with a total of 300 in the entire plant.

The company specializes on heavy machine work, and the arrangement of a direct-connected foundry and machine shop facilitates easy and rapid handling of the heavy pieces. Such an arrangement is made possible by the mildness of the climate, permitting open windows and doors at all seasons of the year, so that the shop is not disturbed by gases and smoke from the foundry. The shop is divided into three bays, the main bay being served by one 15-ton and one 25-ton crane, with a 10-ton crane in one side bay. The same crane arrangement exists in the foundry end of the building. All of the heavy machine tools are motor driven, but there are two line shafts on the sides for the group driving of small miscellaneous machines.

The sugar-mill replacement roll shown in Fig. 1 is being bored on a heavy-duty special lathe. The roll is 37 in. in diameter and 84 in. long, weighing approximately 28,000 lb. It is cast of a special mixture of cast iron giving high tensile strength and an open grain to prevent the roll from running "slick," or refusing to take the sugar cane. The life of the roll is from 2 to 5 seasons depending on the quality of the iron and the hardness of the cane. The roll is strapped in a double cradle on the bed of the machine and the boring head travels along the bar *A*, which is also supported in the tailstock. The movement of the two cutting tools is controlled by a star-wheel on the feed screw in the bar, the lengthwise motion being transmitted to the tool by means of a half nut on the tool head. Three boring cuts are taken, the limits being plus or minus 0.002 in. on each cut. The shaft is then turned for a heavy-shrink fit on the roll, and after assembling the roll is turned on the outside and faced on the ends. The roll is made for a press fit on a steel shaft at 1,000 tons, and a requirement is that it have a bearing throughout the entire length of bore. No keys are used for holding. The job of setting up and boring the roll takes from 15 to 20 hr., floor-to-floor time.

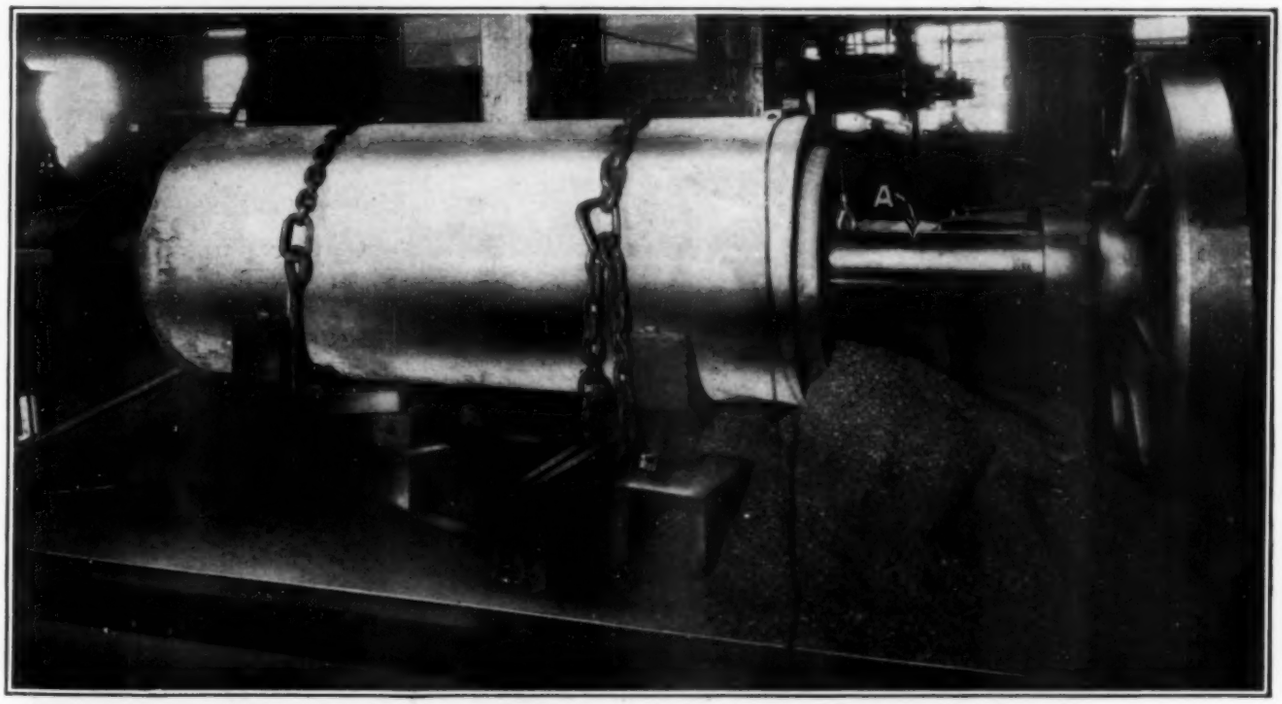
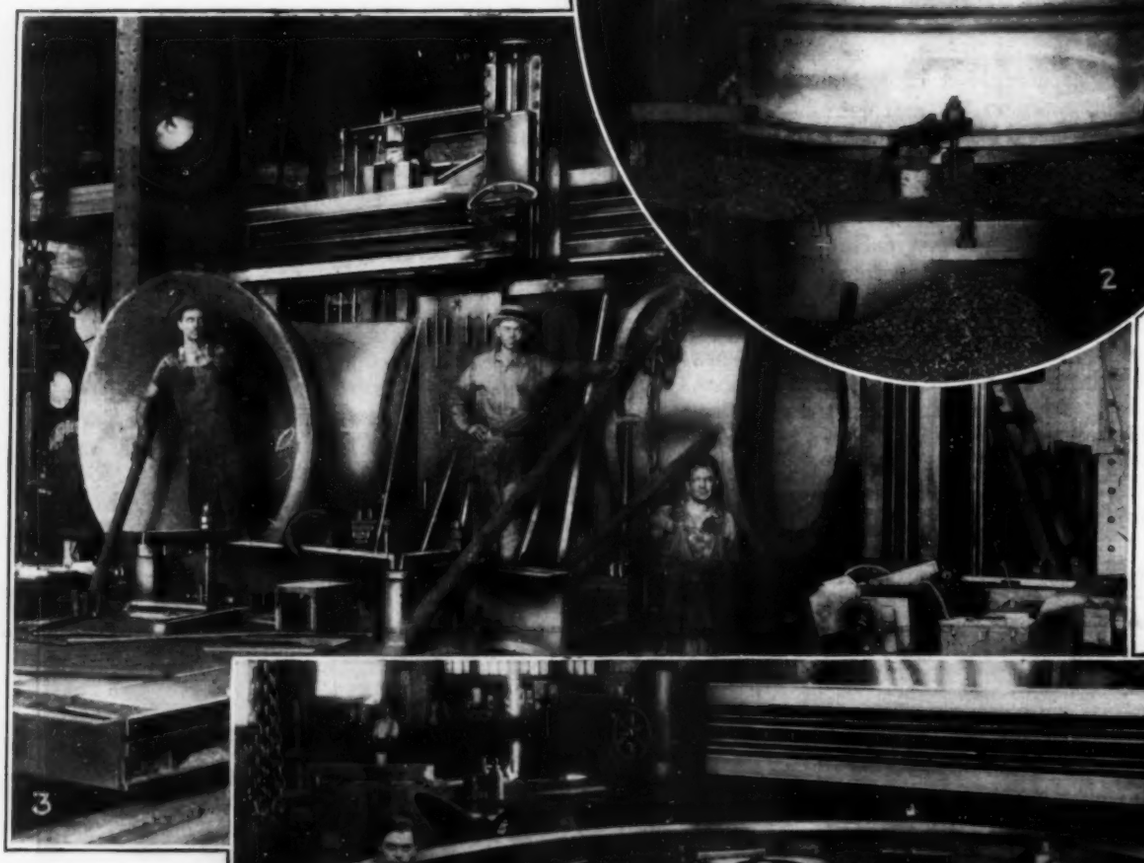


Fig. 1—Boring a sugar-mill roll on a special machine

Fig. 2—Boring the 80-in. diam of a cotton compress cylinder. The boring bar and star-wheel feeding attachment are strapped to the crossrail of the boring mill

Fig. 3—The facing of this powerhouse intake connection was done on a planer, although the largest machine available had a narrower width beween uprights than the length of the pipe. Estimates for contract jobs are made by shop conference, so that methods of handling unusual work are considered in advance of taking the contract



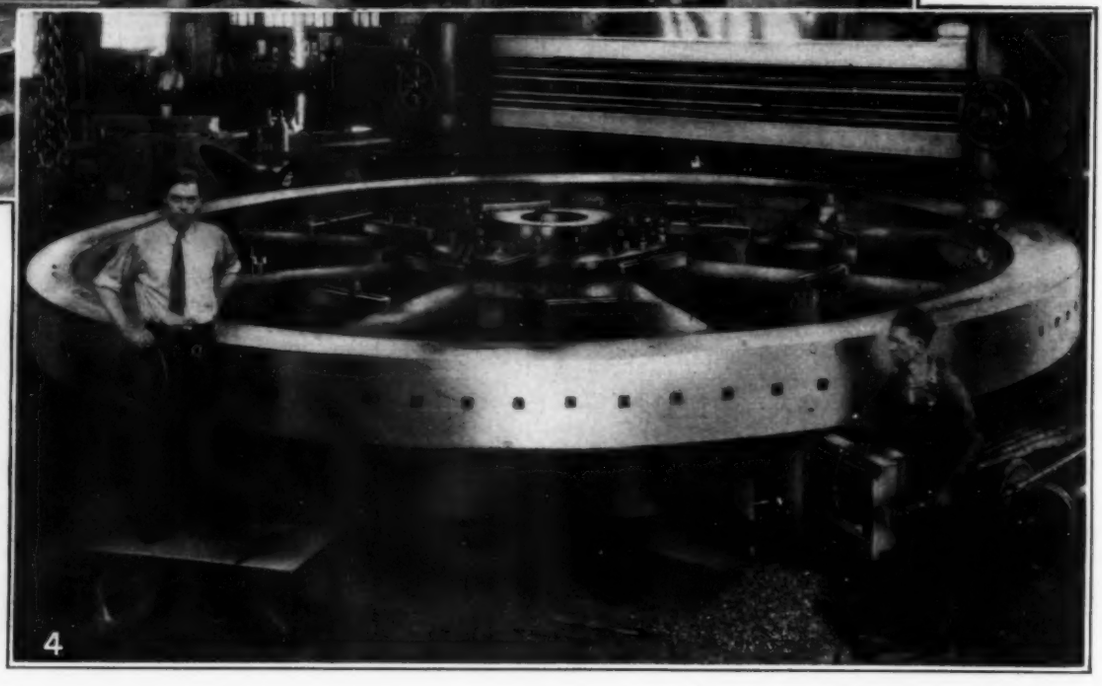


Fig. 4—This 22-ft. flywheel just "got by" on the 16-ft. boring mill. The wheel is made in sections and shipped in parts to be shrunk together in the field

The cylinder shown on the boring mill in Fig. 2 is a semi-steel casting 94 in. high, to be bored to a diameter of 80 in. Close accuracy is required in the diameter, and the bore must be straight and round. The cylinder is for a cotton compress and is designed to carry 150 lb. per sq.in. of steam pressure. The casting weighs 30,000 lb. The boring is done with a special fixed boring bar mounted on the rail. The cutter head is fed downwards by means of a star wheel. Three cuts are taken, and the floor-to-floor time of the job is from 50 to 60 hours.

The 60-in. bell-mouthed pipe connection shown in Fig. 3 is a contract job from a large hydro-electric company. The flanges were faced in the planer. Another power-house contract job is illustrated in Fig. 4. The flywheel is 22 ft. in diameter, and weighs 110,000 lb. It was made in 8 sections, each section consisting of an arm and a corresponding part of the rim. The hub was also made separately in two pieces and machined all over. The arm sections are held in place with fitted bolts and the rim sections are held together by shrink links. After turning in the boring mill the wheel was shipped in sections, and when assembled in the field the links were shrunk in.

Finishing by rolling is employed for steel rolls for hydraulic gates and for heavy sugar machinery. The

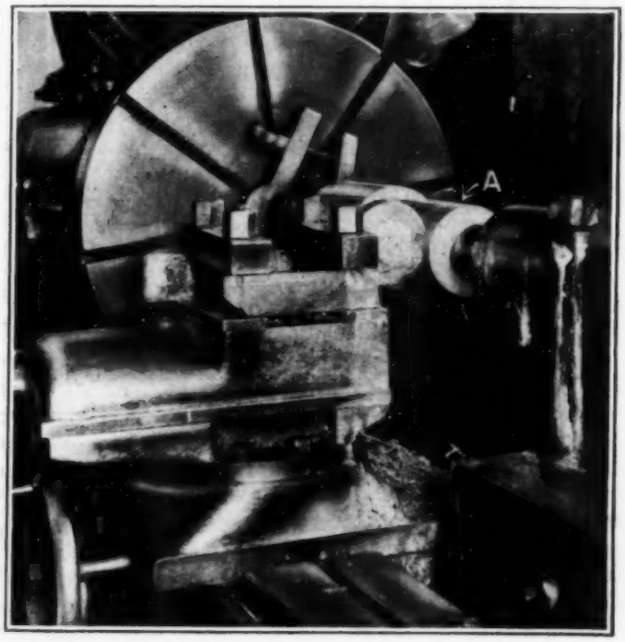


Fig. 5—Rolling the finish on a heavy-duty journal

roller shown at *A*, Fig. 5, is of open-hearth steel having a tensile strength of 60,000 to 65,000 lb. per sq.in., and is intended to carry very high bearing pressures. The journals are "semi-finished" with an ordinary tool, allowing from 0.001 to 0.003 in. for reduction by rolling. The hardened roll is held in a special toolpost holder, and one run only is required for finishing. The finished surface has a high polish and is dense and hard.

The posts for cotton compresses, shown on the planer in Fig. 6, weigh 15,000 lb. each. Two posts are handled at a time, and 3 separate cuts are being taken at the same time. The castings are of semi-steel, and 1-in. cuts are being taken with a $\frac{1}{8}$-in. feed. The floor-to-floor time for the two posts was 36 hours.

Practically all work done in the shop and foundry is obtained on contract, most of which is by competitive

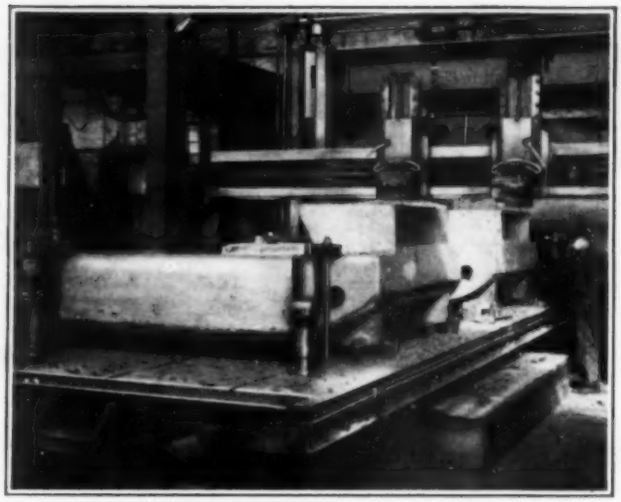


Fig. 6—Planing the heavy side posts of a cotton compress

bidding. The work consists in the building of complete machines such as cotton compresses, or in the making of renewal parts and repair work for steel mills, cotton and sugar mills, chemical plants, and power plants. Before bidding on a job the required work is analyzed by the shop staff, and the estimated time for an operation becomes the task time for the workman.

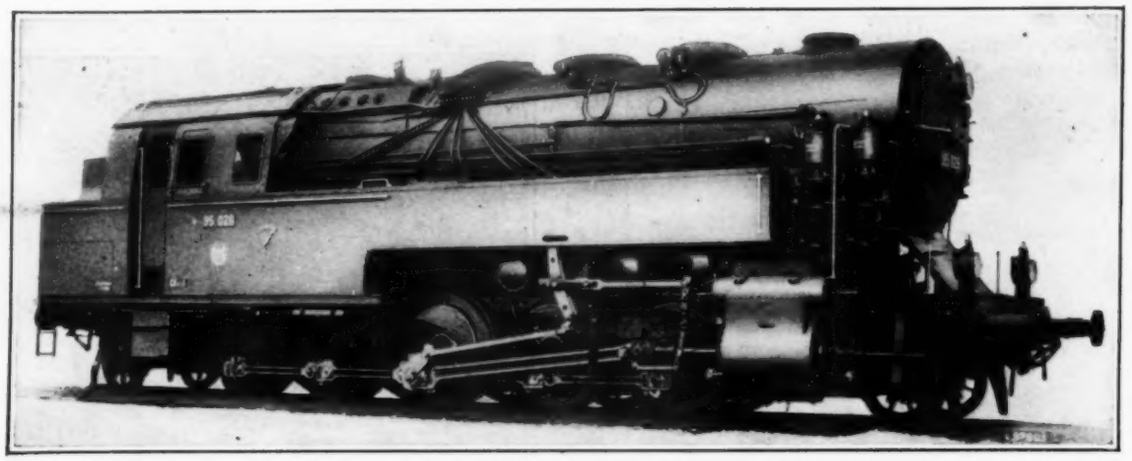
Substitution of Steel Castings for Cast Iron—*Discussion*

By B. H. Johnson

ON PAGE 626, Vol. 68, of the *American Machinist*, H. J. Hart advocated the use of steel castings in the place of cast iron in the manufacture of machine tools. Steel in various forms is already used where engineering principles require it. A great many machines in use today, notably punches, presses, and rolling machines, are made of steel. But in all cases where bearings occur and steel castings are used, it is necessary to make use of bushings for rotating surfaces or shoes for sliding surfaces.

It is a known fact that cast iron, properly machined and fitted, makes one of the best bearing surfaces of any of the metals. Making compound rests and slides, or carriage cross-slides of steel, would necessitate the introduction of shoes in order to give the proper bearing surfaces. The more parts used in the construction of any machine means more chance of inaccuracy, which is detrimental to machine tools. Moreover, cast iron has the quality of rigidity not possessed by steel, a quality absolutely necessary in the construction and operation of machine tools. These are two of the important reasons why cast iron is infinitely preferable to steel castings in the fine machine tool construction required today, and two real reasons why steel cannot be substituted for cast iron generally.

Rather than substitute other metals or materials for cast iron, the solution is to make cast iron better, so that it will stand the additional work demanded by modern requirements. This condition is known and realized by progressive gray-iron foundrymen. The Gray Iron Institute, recently organized, has for its object, among others, just this work of developing the proper gray-iron castings for the right requirements.



Standard type of locomotive for freight trains

Locomotive Standardization in Germany

By Georges Harvaci
International Management Institute, Geneva

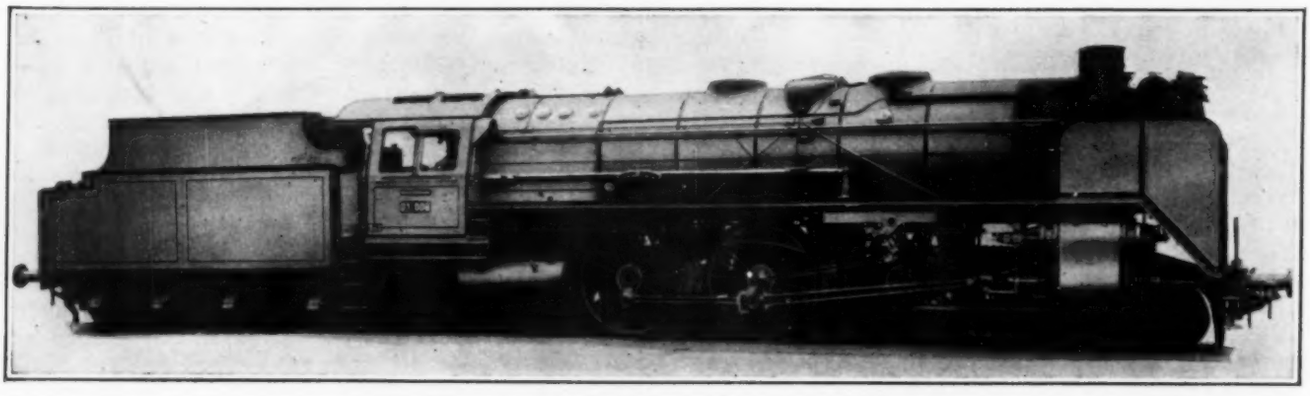
Standardization now applied to railway equipment in Germany has reduced the number of locomotive types from two hundred ten to sixteen

In 1920, when the German Government took over the railways, there were 210 different series of locomotives in use. The need for standardization was immediately apparent. It was difficult, however, to accomplish this rapidly, adopting existing locomotives as standards, because the existing engines had not been designed with standardized components. It was necessary to create new series to meet the variable conditions of service on the different lines. At the same time, work in the shops had to be reorganized in order that each shop might specialize on the maintenance of a few types of locomotives, thus reducing the stock of spares. A special commission, constituted by the Ministry of Transport, concluded that entirely new types must be designed and standardized with completely interchangeable parts.

Immediately after the inauguration of the German Industrial Standards Committee, the builders of locomotives combined to form the General Locomotive Standards Committee. This organization has worked consistently towards the standardization of spare parts on an economic basis. In order to further the standardization of components and processes of machining, a special sub-committee was formed by co-operation between the National Railways and industrial representatives acquainted with the technical requirements of machining and construction.

The work of the sub-committee has been carried out

Photographs courtesy of German Railroads Information office.



Standard type of locomotive for express trains

by dividing the studies of different parts and processes between specialists in one of the branches of production. Details thus established have been completed by the comments of other manufacturers, or of the National Railways, for consideration by the sub-committee and ultimate reference to the General Committee. Final decision in all matters relating to the standardized series of locomotives rests with the general management of the National Railways.

In order to restrict the number of different components it was necessary to design them symmetrically wherever possible, thus allowing for right- or left-hand mounting, and also to provide for interchangeability between different types of locomotives in the repair shops.

A new organization was required for the complete investigation of the possibilities of standardization thus contemplated. A Locomotive Standardization Bureau of the National Railways was therefore established at Tegel, near Berlin, all of the principal builders of locomotives in Germany sending qualified personnel to assist in the work. Starting from the elements already standardized by the general and sub-committees, the Standardization Bureau proceeded to the study of a new series of locomotives in collaboration with the central administration of the National Railways.

The preliminary investigation has been completed and a number of standardized series have been developed. The Standardization Bureau has prepared general drawings to a scale of one-fortieth. and these having been studied by the Locomotive Division, have been approved by the general management of the National Railways.

It is proposed to build the series of locomotives shown in the following list. Some of these standards have already gone into production. Two of these are shown in the illustrations.

Standard Types of Main Line Locomotives

1. Type 4-6-2 for fast service. Two sub-series are contemplated, four-cylinder compound and simple-expansion two-cylinder engines, in order to determine which is the better way of utilizing superheated steam.
2. Type 2-8-2, three-cylinder locomotives for local passenger trains.
3. Type 4-6-0, two-cylinder locomotives for local passenger trains.
4. Type 2-10-0, freight locomotives, in two sub-series, with two and three cylinders respectively, simple expansion in both cases, in order to campare the two methods.
5. Type 2-8-0, two-cylinder locomotives for freight trains.
6. Type 2-6-0, two-cylinder tank locomotives.
7. Type 4-6-4, two-cylinder tank locomotives for local passenger trains.
8. Type 2-6-2, two-cylinder tank locomotives for local passenger trains.
9. Type 2-10-2, tank locomotives for freight trains. As in the case of the 2-10-0 type mentioned above, the performances of two- and three-cylinder locomotives with simple expansion are to be compared.
10. Type 2-8-2, tank locomotives for freight trains.

As a starting-point in the design of all these types of main-line engines, the axle-load has been fixed at 20 tons. All main-line locomotives are provided with feedwater heaters.

Standard Types of Shunting Locomotives

For shunting service the following series of locomotives are proposed, using saturated steam:

11. Type 0-10-0, tank locomotives for shunting in stations with heavy track.
12. Type 0-8-0, tank locomotives for shunting in stations with medium-heavy track.
13. Type 0-6-0, tank locomotives for shunting in stations with light track.

The weight on the rails in these cases is fixed at 20 tons per axle for the 0-10-0 type, and 17½ tons for the 0-8-0 and 0-6-0 types.

Standard Types of Branch Line Locomotives

For station service and lines of small traffic, locomotives with a loading of 15 tons per axle are under investigation, the series being:

14. Type 2-6-0, locomotives for passenger and freight trains.
15. Type 2-6-0, tank locomotives for passenger trains.
16. Type 2-8-2, tank locomotives for freight trains.

Principal Dimensions of Standard Locomotives

Having thus established 16 standardized types of locomotives, the principal dimensions have been standardized as follows:

(*a*) External diameter of boilers: 74.80, 70.87, 66.93, and 59.06 inches.

(*b*) Internal diameter of cylinders (except in compound engines): 25.59, 23.62, and 22.44 inches.

(*c*) Piston stroke: 25.98 in. for main-line locomotives, and 24.80 in. for shunting locomotives.

(*d*) Diameter of driving wheels:—
78.74 in. for fast and express service.
68.90 in. for local passenger trains.
55.12 in. for freight engines.
49.21 in. for shunting engines.

(*e*) Diameter of leading and trailing wheels:
33.46 in. for four-wheel trucks.
49.21 in. for two-wheel trucks.

As regards the details of construction and equipment, all of the locomotives using superheated steam will be fitted with superheaters consisting of four 1.18—1.50 in. tubes in a 4.92—5.24 in pipe; when the length of the tubes exceeds 16.4 ft. the diameter of the large pipe will be 5.32—5.63 in. All of the engines are mounted on bar frames. Because of the length of the boiler in the main-line engines, a leading truck is to be used in all cases, including freight engines. The trailing trucks are the same as the leading ones in the tank engines for line service. Experience shows that, even on freight engines, the leading and trailing wheels reduce wear on the track and driving wheels.

The leading trucks of the 4-6-2, 4-6-0, and 4-6-4 locomotives are the same, and so are the trailing trucks of the 4-6-2 and 2-8-2 locomotives. All the leading and trailing trucks of the freight engines, with or without tenders, are interchangeable. In general, the Belpaire firebox is abandoned, bar-type main frames are adopted, and the two-wheel truck is adopted.

By restricting the number of types of engines, it becomes possible to order the machines in large series, while interchangeability of components facilitates and cheapens maintenance. The amount of engineering work is reduced by standardizing the design of certain components and, apart from the reduction in the number of spares, there are savings in the number of dies, templets and gages, and the general procedure in the repair shops is simplified. The higher degree of specialization, made possible by concentrating on the maintenance of a smaller number of types of engines, results in quicker repairs.

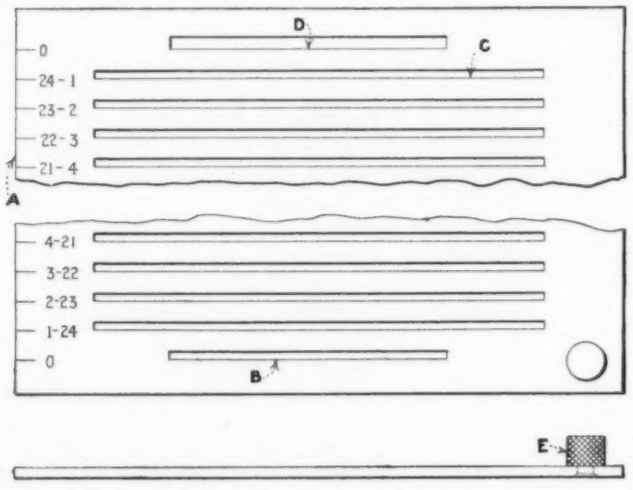
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Templet for the Stock Lists on Drawings

By J. E. Fenno

The sketch illustrates a very handy tool for the draftsman when ruling the lines on the drawing for the stock list. It has proved to be a time saver, because it eliminates preliminary pencil work and space measuring. In use, the bottom of the templet is placed against the top edge of the T-square with the zero graduation registering



Templet for drawing stock lists

with the top line of the title inclosure. The vertical lines of the list are projected from the dividing lines of the headings, along the graduated edge *A*, for the number of spaces necessary.

To draw the horizontal lines, the templet is located with the lower edge of the opening *B* on the top line of the title inclosure and the lines are ruled against the edges of the slots, as at *C*. The graduations read both upward and downward so that the templet can be used when the title inclosure is at either the top or the bottom of the drawing. If at the top, the lower edge of the opening *D* is placed on the bottom line of the inclosure. The templet is made of $\frac{1}{16}$-in. ground steel and is saw-slotted to provide the ruling edges. The knurled knob *E* is for convenience in lifting the templet from the drawing board.

A Rotary Fixture for a Part Difficult to Hold

By C. W. Frank

Milling the flats on door-closer pistons, such as the one shown at *A* in Fig. 1, was made somewhat difficult due to the small amount of gripping space outside of the

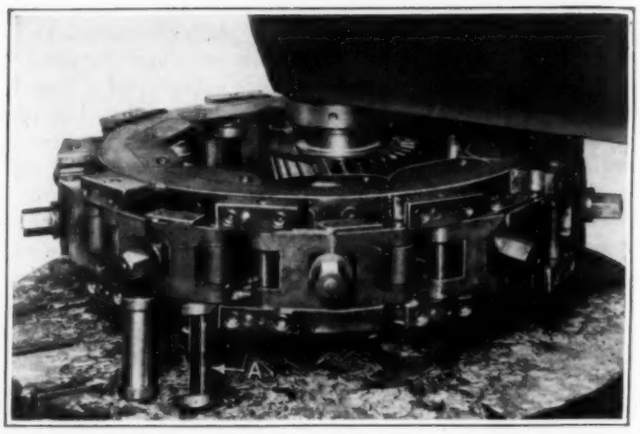


Fig. 1—Rotary milling fixture having ten stations

center line. The problem was solved by toggle clamps, such as the one illustrated in Fig. 2, in which the work is located against the serrated-edged stationary block *B* and is held in place by the clamp *C*, pivoted on the pin *D*. When the clamping nut is tightened, the toggle plates force out the end of the pivoted clamp, causing it to hold the work between its serrated edge and that of the stationary block.

Ten such clamps were built into the rotary fixture shown in Fig. 1, in which the pistons are loaded and unloaded as the table revolves. The material is 0.1 to 0.2-per cent carbon steel and the width of the cut is $3\frac{7}{16}$-in. The speed of the cutter is 40 r.p.m., the feed being 0.31 in. per revolution. The production is 150 pieces per hour. The diameter of the cutter is $2\frac{9}{16}$ inches.

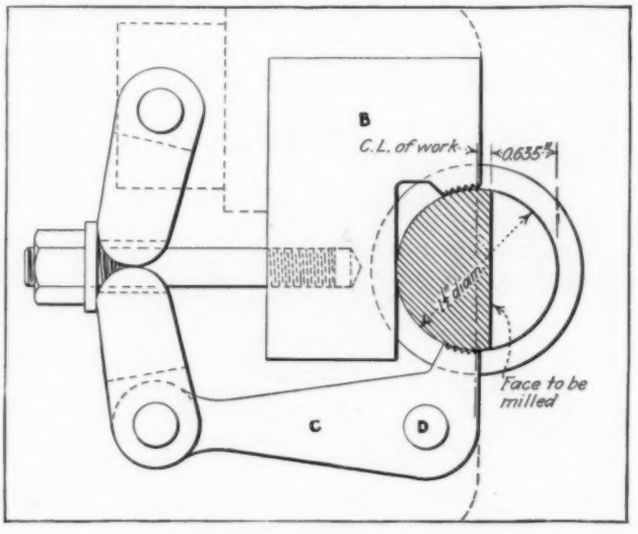


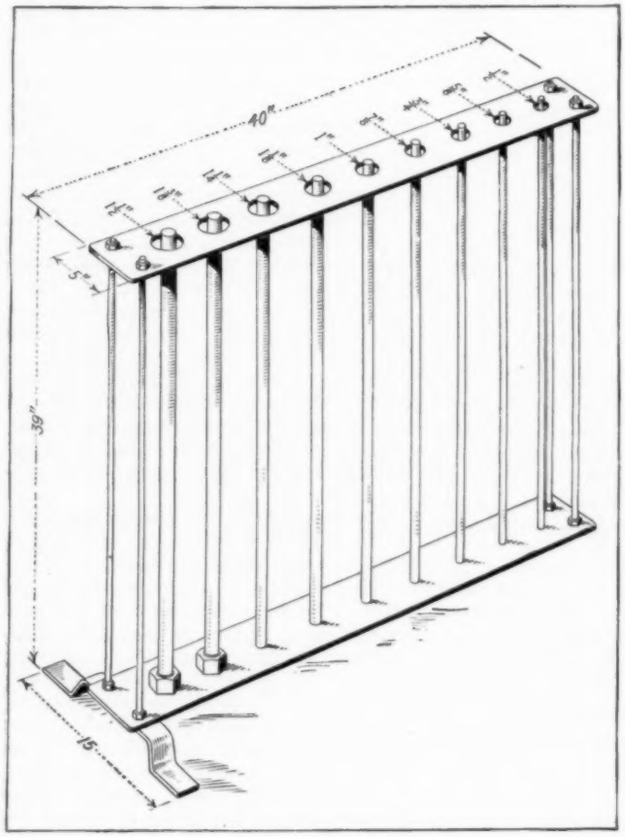
Fig. 2—Details of the clamping device

A Convenient Nut Rack for the Erecting Shop

By Louis L. Locke

The nut rack illustrated is used in the shops of the Illinois Central System, though it will be found valuable in any plant where different sizes of nuts are used in assembling.

The vertical rods are of sizes that will allow ½- to 1½-in.



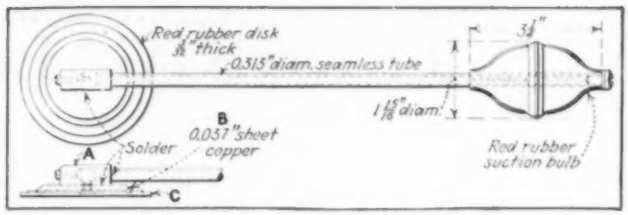
A rack for hexagon nuts

nuts to be slipped over them. At the top is a gage plate having a number of holes, each of which is slightly larger in diameter than the distance across the corners of the nuts to be held by the several rods. Between the diameters of the bars and the sizes of the holes in the plate, it is almost impossible to place a hexagon nut in the wrong division of the rack.

Vacuum Lifter for Press Work

By J. S. Browne

A simple vacuum lifter for putting in and removing blanks from press dies, in places where no compressed air supply is at hand, is shown in the illustration. This lifter was designed and is used in the plant of the Westinghouse Electric & Manufacturing Company. The bulb is a commercial red rubber bulb cemented to the end of a standard seamless tube cut to the desired length. The tube is soldered into the brass block *A*, which is, in turn, soldered to the formed copper disk *B*. The disk *C* is cut from standard red rubber sheet, and is fastened in the center to the block *A* by a No. 10-32 screw and a thin copper disk. In operation, the bulb is squeezed in



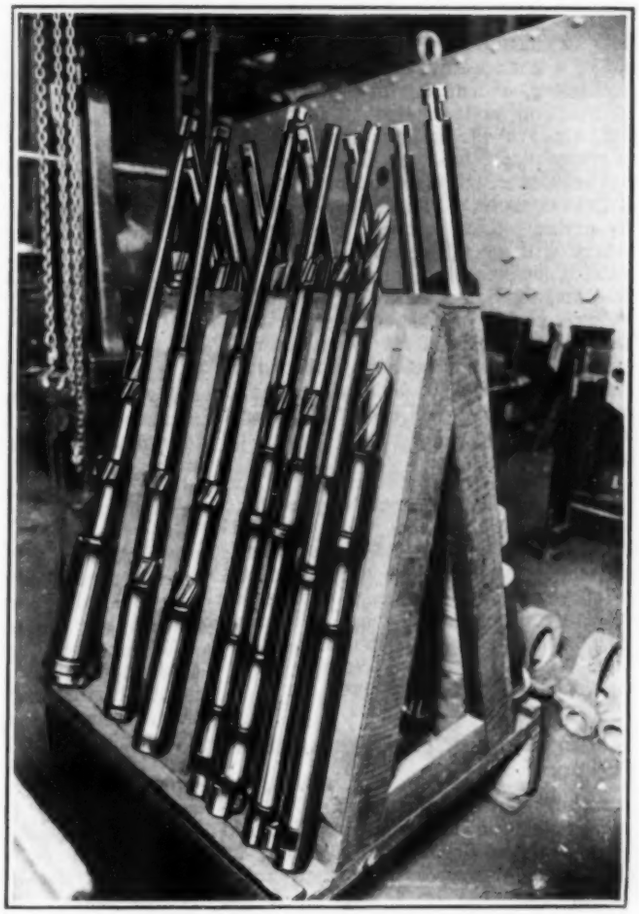
Vacuum lifter for feeding press dies

the hand, and the disk is placed over the blank to be lifted. When the pressure on the bulb is released the rush of the air around the rubber disk to fill the bulb, picks up the blank, and holds it tightly until the bulb is again squeezed.

Rack for Boring Bars and Reamers

By Henry C. Franklin

Handling large boring bars between the tool crib and the machines on which they are to be used, and keeping them safely both in and out of the toolcrib, is a real problem and one that is met in different ways. Utilizing the lift truck in this connection, the Cincinnati Shaper Company builds tool racks as shown in the illustration.



Rack for storing and handling boring bars

The platform is of proper height for the lift truck to go under and the angle of the sides was selected to insure stability and at the same time not let the long bars interfere with each other at the top. The partitions are triangular strips that make it easy to get hold of the bars.

TECHNICAL · ABSTRACTS

The Missing Market

The main reason why industry throws a million or more men out of work every so often is that the flow of money to consumers does not keep pace with the flow of consumers' goods. The right flow of money to consumers from the expansion of money in connection with the construction of public works, and in connection with the construction of capital facilities, has never lasted for any length of time. There is no reason why it should, for in the first place, we have no means of knowing what the needs are, and in the second place, no one has the authority or responsibility for doing anything towards supplying the needs. Under such conditions, business cannot possibly remain stable for any length of time.

In order to curb such movements, as those which throw men out of work, we must obtain more accurate and more timely information concerning the changes that accompany the ebb and flow of business activities. With the aid of a national system of employment exchanges, we can obtain the necessary information at a cost that is trifling compared to the billions that are lost in every major business depression.

The United States Government, the largest consumer in the world, should do nothing that involves transfers of money without taking into account the state of business and employment at the time and the consequent effect on public welfare of the fiscal act in question. Tax reductions, tariff revisions. expenditures for flood control and public buildings, reclamation of waste lands, and payments of the public debt, all affect business—there is no escape from this conclusion.

We propose the formation of an agency that, in a general way, will do for commodity markets what the Federal Reserve System has done so well for money markets. We propose to add to our exceedingly efficient system for financing producers, an equally efficient system for financing consumers.—William Trufant Foster and Waddill Catchings, *The Worlds Work*, June 22.

The Principal Belgian Automobile Producer

Although Belgium occupies a secondary position in the automobile world from the point of view of output, its cars are known in every corner of the world, and rank in quality with the leading cars of other countries. This world-wide reputation has been gained largely through the product of Minerva Motors, of Antwerp. Minerva has 45 foreign agencies in many countries. The estimated total Belgian output of automobiles in 1927 was 6,500 units, of which Minerva accounts for about half.

Minerva Motors was founded in London in 1903, with a capital of 3,250,000 francs, for the purpose of taking over the interests of M. Sylvian de Jong, of Antwerp, who had turned out his first motor vehicle in 1900 under the trade name of "Minerva." In 1908, the factory adopted the Knight valveless motor, and since that time Minerva Motors as a producer of de luxe automobiles has shown a constant and rapid growth.

The original capital has been expanded to the present 54,800,000 francs. The company is now operating with 4,500 workmen and 800 office employees. It is equipped with more than 2,000 machine tools, and 500 electric motors of a total of 4,000 horsepower. At the present time it consists of seven different factory units. The strong points of the Minerva organization are skilled labor and untiring inspection. The company has its own professional school for mechanics, through which the plants are assured of a plentiful supply of a superior grade of labor. In spite of excellent machinery equipment, there is a surprising amount of bench work performed, and throughout many of the shops handwork predominates. The Minerva line consists of 12-, 20-, and 32-hp. passenger cars, all 6-cylinder, and of 6- and 10-ton tractors.—Leigh W. Hunt, *Commerce Reports*, June 18.

Reducing Labor Cost with High-Speed Steel Taps

The use of high-speed taps results in large labor savings in the proper field, which is that of tapping a large number of holes by power for sizes not less than $\frac{1}{4}$ in. in diameter. In most cases they are less likely to break at high than at low speeds, being successfully operated at speeds up to 200 ft. per minute. Reversing tapping machines are now made that will operate without trouble at 10,000 r.p.m., and many tapping operations are carried on at 4,000 to 6,000 rev. per minute.

We are told that high-speed machine screw taps break so quickly that there is no chance to get more work out of them than out of carbon-steel taps. This is not true, for the strain necessary to break taps in properly designed work is much greater than the power required to tap holes with them. The experience of one manufacturer in tapping holes in cast iron, using No. 40 taps, illustrates this point. He was getting 1,500 holes per carbon-steel tap. High-speed taps now average 18,000, and sometimes give more than 30,000 holes. Bakelite, hard rubber, and fibre do not put much strain on taps, but will wear them out very fast. High-speed steel taps are far better for this type of work as well as for metal.—*Timely Taps*. Vol. 1, No. 11.

Management and Purchasing

Management believes that its purchasing agent should have an intimate knowledge of the commodities required for the successful operation of its business. Unless he has this knowledge, how can he hope to cope with the well-equipped salesman or industrial selling engineer? Besides an intimate knowledge of nearby markets, management expects the purchasing agent to follow world events which tend to influence either domestic markets or imports.

Knowledge of the functions and uses of the commodity manufactured is, of course, a prime essential. If the firm makes machine tools, the purchasing agent should know at least the fundamental principles of machine shop practice, and he should know where every bar of steel or casting, or forging, or stamping, or piece of lumber is used on the machines produced, so that he will know why he is buying a particular article or commodity. This indicates intelligence, and every one of us likes to be classed as intelligent.

Too many times the purchasing agent is left entirely to his own devices, with the result that the same things are being requisitioned year after year. This is often the case with so-called one-man departments, where the single purchasing agent carries on practically all of the buying. He gradually becomes too well satisfied with himself for the good of the concern he represents. Very seldom does anyone check his actions or measure the result he attains by any standard of measurement. This is partly the purchasing agent's fault, but it is also the fault of management.

Management expects that the man who represents it shall be a happy combination of gentleman, diplomat, philosopher, and at times a ten-minute egg. We are told that the purchasing agent should be highly ethical, and also told that the only really satisfactory transaction is one that is mutually satisfactory to both buyer and seller. Too often of late the purchasing agent has been blamed because he has forced prices down to a ruinous point. But can a man be blamed because he is able to take advantage of a weak selling situation? With over-production, and great mills hungry for business, the buyer naturally is going to take advantage of this situation just as long as it exists. I like to see every concern doing business at a satisfactory margin of profit, but more than that I like to see the purchasing agent exercising that prerogative which is the biggest excuse for his existence, namely, the procurement of supplies and raw materials at the right price, consistent with the purpose for which they are intended; so, too, does management. — Paul R. Brennan, *Purchasor* June 1.

Abrasive Materials

Abrasives. The natural abrasives include the diamond, emery, corundum, sand, crushed garnet and quartz, tripoli, and pumice. The artificial abrasives are marketed under many trade names, but are in general either silicon carbide or aluminum oxide. For general industrial grinding, artificial abrasives are usually preferred to natural abrasives, because of their greater uniformity. The abrasive grains are used as a grinding powder, or are made into wheels, into "stones," or are bonded to paper or cloth. The massive natural material, such as sandstone, is often cut into wheels from the block. There are two general processes for making abrasive wheels: Vitrified wheels are made by running the mixture into molds, and when dry subjecting to intense heat. The silicate process consists in tamping the material into molds with a silicate of soda binder, and then baking in an oven. Synthetic resins, such as the phenol resins, are sometimes used instead of the silicate as binders, where greater strength is required than is obtained with the silicate but less than with the vitrified. Vulcanized rubber is used as a binder where still less strength is required. A binder of shellac is used on wheels for light work and for finishing. The choice of binder is important, as it must be just strong enough to hold the grains together to obtain the desired results, and to release them before they become too dull. The hardest abrasive is the diamond, having a hardness of 10 on the Moh scale. Garnet is one of the softest of the "hard" abrasives, with a hardness of 6 to 7.5 on the Moh scale.

Aluminum oxide. An artificial corundum, Al_2O_3, made by fusing the mineral bauxite in a special arc-type electric furnace. When pure, it is a white powder, or it forms in colorless crystals, and in the latter form is employed as an abrasive. It is also employed in making refractory linings, crucibles and firebrick, and for this purpose is mixed with 10 to 25 per cent of refractory clay as a binder. The specific gravity of aluminum oxide is 3.73, and the melting point is about 3,720 deg. F., and hardness about 9 on the Moh scale. For abrasive purposes it is used in various grades, depending upon the purity. When hard, sharp crystals are required the highest grades are employed, but it is usually preferred with some impurities for average use. The crystals are minute, and the larger grain sizes are made up of many crystals, which is a distinctive point from silicon carbide. For industrial abrasive uses, artificial aluminum oxide is usually preferred to corundum or emery, because of its greater uniformity. It is generally marketed under trade names, such as Alundum, and Aloxite. The brands may vary in purity, but the grading is done chiefly according to grain size.

Silicon carbide. A bluish-black crystalline artificial mineral of the composition SiC, having a hardness of 9.5 on the Moh scale, and used as an abrasive in the form of powder, paper, wheels, and hones. It is also used as a refractory material, being bonded with clay, or held together with its own crystals by a method of recrystallization. Silicon carbide is a product of the resistance-type electric furnace, and is made by fusing sand and coke with sawdust, using salt as a flux. The temperature used is just above 4,000 deg. F. Silicon carbide was discovered accidentally in 1891. The specific gravity is 3.12 to 3.20. Pure silicon carbide should contain 70 per cent of silicon and 30 of carbon, but the commercial grades usually contain less silicon, and have small amounts of iron oxide. Unlike aluminum oxide, it is composed of large crystals, which are crushed to obtain the small grains used for abrasive purposes. It is harder than aluminum oxide, and is employed for the hardest types of grinding wheels. Silicon carbide is sold under a great variety of trade names, such as Carborundum, Crystolon, Carbofrax, Carbora, Carborite, and Crystolite.

Bort. A name used to designate diamonds that are used for abrasive purposes. It includes stones that have a radiating crystallization which will not take a fine polish, and, therefore, cannot be used as gem stones. It also includes an amorphous variety of diamonds in brown, gray, or black colors, known as black diamonds, and found in Brazil in association with gem diamonds. The average size is from 2 to 4 carats. The largest found weighed 3,078 carats. The amorphous variety of diamonds is also extensively used in diamond drills and cutting tools. The diamond crystal is almost pure carbon, and is the hardest known substance, being set at 10 on the Moh hardness scale. Pure crystal diamonds of acceptable gem colors, however, are too expensive for use as abrasives, and splinters as small as 1/500 carat are cut and facetted as gems. Diamond dust, used for grinding and polishing hardened steels, is a powder obtained by crushing bort, or from the refuse from the cutting of gem diamonds.

Tungsten Carbide. An iron-gray powder of minute cubical crystals, and having the composition WC. The specific gravity is about 16, and the hardness is 9.8 to 9.9, or nearly that of the diamond. The melting point is claimed to be 5,400 deg. F., but if strongly heated it is apt to decompose into W_2C and carbon. Tungsten carbide is produced by carbonizing incandescent tungsten in a methane or hydrocarbon vapor, and other forms may be produced, namely W_2C, W_3C, and W_3C_4. Tungsten carbide is used as an abrasive, or is briquetted with cobalt or other binders into tools for the high-speed cutting of metal. The products are marketed under trade names, as Widia metal, Phoran, and Carboloy. Tungsten carbide is made commercially by the Osram Laboratories, Berlin, and by the General Electric Company.

(Continued on sheet 37a.)

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Modern Locomotives and Their Upkeep

THE old steam locomotive is as tenacious as the fabled cat with nine lives. Our electrical friends have been consigning it to the scrap heap for the past forty years. But, if we can judge by the locomotives exhibited at the recent railway convention in Atlantic City, there is a lot of life in the old dog yet. Limited by track width and bridge height, expansion is largely lengthwise, although higher steam pressures and larger cylinders also are used.

A study of these new locomotives, with their parts increased in size to take care of the greater power developed, emphasizes the need for better and larger machine equipment in the railway shops. Increased accuracy and adequate facilities for handling the heavy parts are necessities for the modern railway shop.

Time, also, is becoming a more important item than ever before. Larger locomotives mean increased investment, and heavier losses every day a locomotive is out of service. This makes efficient shop equipment necessary in order to reduce the idle time and so add to the earning power of the modern locomotive. Those who control railroad shop expenditures must consider modern shop equipment more than ever before.

Effects of Our Loans Abroad

WHY do United States investors lend so much money for industrial and public utility development abroad? No doubt the chief reason is that the yields or the terms of such loans, or both, are very attractive. But it must not be supposed that our bankers lose sight of the increased consumer demand for commodities, of which the United States manufacturers will sell their share. As expressed by Mr. Hoover, "by contributing to peace and economic stability, by the loan of our surplus savings abroad for productive purposes, we can contribute to the elevation of the standards of living in foreign countries and the demand for all goods."

Figures given out by Dr. Julius Klein, of the Department of Commerce, show that our private investments now yield annually about $740,000,000 in interest. They show, also, loans of $7,000,000 to Greece, $15,000,000 to Ireland, $170,000,000 to Poland in the last ten years, $900,000,000 to the Germans since the War, and even more to the Canadians.

In Greece, the loan made possible rehabilitation of one and a half million exiles, now useful producers and consumers of the world's commodities. In Ireland, a hydro-electric development was financed. Public utilities have been developed in Poland, as in Germany. Many were the results in Canada, now our best foreign market, with purchases that probably will exceed $850,000,000 this fiscal year.

A given nation is likely to prosper as the world at large prospers. The merchant in a small town cannot do a paying business unless his patrons, who are also his neighbors, are in a condition of well-being. Nations are in about the same relative position—it is necessary that their neighbors have high standards of living and a strong consumer demand for goods—in other words be prosperous. Neighbors, in a world sense, include all nations; today's methods of transportation take care of that.

Even our enormous loans abroad, then, so far as they have been made for constructive purposes —to develop industries and public utilities, to raise standards of living—and so far as they have been carefully and honestly selected, are increasing our export business and helping us to maintain our present very satisfactory prosperity.

The Cost of Distribution

DISTRIBUTION costs are beginning to receive more attention, and it is well, for they play just as important a part in the final price to the consumer, as does the cost of manufacture. Modern machinery and methods have reduced labor costs to points that are unbelievably low. Selling costs, in such cases, usually seem abnormally high.

To stimulate thought and discussion along this line Alvan T. Simonds, through the American Management Association, has offered $1,500 in prizes for the best essays on Reducing the Cost of Distribution. This is the seventh award offered by Mr. Simonds to arouse more general interest in the subject of economics as related to individual and general welfare and to increase the general understanding of the application of economic principles to business. Such efforts to arrive at a better foundation of business conduct are to be commended.

· SHOP · EQUIPMENT · NEWS ·

Sellers Special Floor Boring, Drilling, and Milling Machine

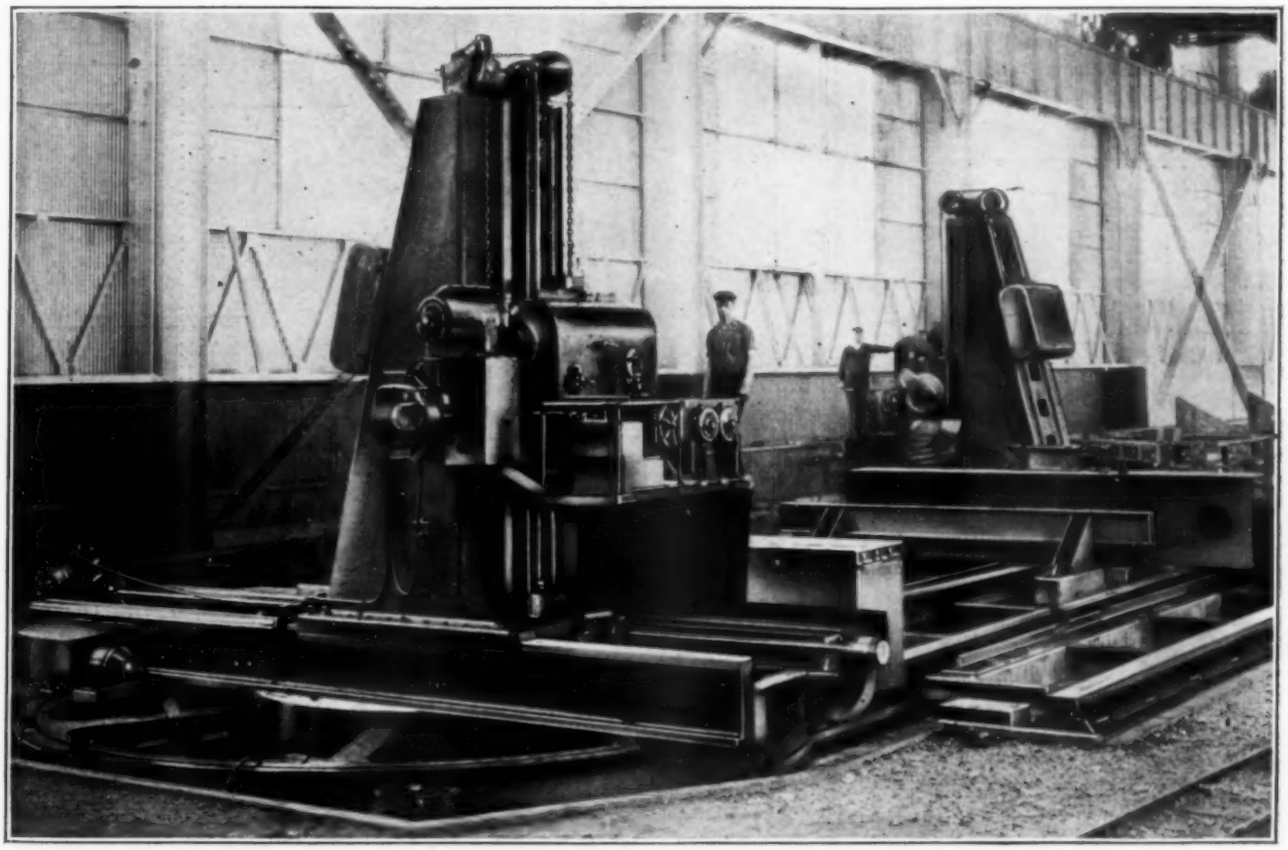
FOR finishing the abutting ends of large built-up structural members for tower and bridge sections, this special floor boring and milling machine has been developed by Wm. Sellers & Company, Inc., Philadelphia, Pa. The ends of columns or structures 20 ft. high, 12 ft. wide and 60 ft. long can be milled on the machine shown in the accompanying illustration. It consists of two milling units mounted on a bed 80 ft. long, each unit consisting of a floor boring, drilling, and milling machine having characteristics similar to those of the horizontal boring, drilling, and milling machine described on page 1032, Vol. 67, of the *American Machinist*.

One unit is mounted on a rotary base at one end of the long bed, and can be swiveled by power to an angle of 45 deg. in either direction, so that the structural members can be finished at an angle as well as square. The other unit is mounted on a sub base adjusted longitudinally on the bed by power. This unit can be placed at the required distance from the unit on the rotary base to finish both ends of sections of any desired length up to the maximum at one setting. Each of the milling units carries with it a slotted work table for supporting and fastening the structural sections. An intermediate support is provided in the form of a four-wheel truck to take care of any sag which might occur in the member being machined. The milling units have the driving motors mounted directly on the head and with full control within easy reach of the operator when standing on the platform.

Each unit is equipped with a wide range of boring and drilling speeds and feeds so that holes in the ends of structural sections can be handled at the same setting as for milling. The horizontal and vertical milling feeds are independent in operation so that by combination feeds can be obtained in any direction. With this arrangement it is possible to change direction without throwing out the milling feed, thereby eliminating the interruption of the feed with its resultant mark in the work.

Milburn Type EF Spray Gun

Any desired spray can be obtained instantly when using this type EF spray gun manufactured by the Alexander Milburn Company, 1416-28 W. Baltimore St., Baltimore, Md. The width of the spray is adjusted by a dial head placed near the nozzle. The volume of the spray is also adjustable by means of a paint valve plunger which is provided with a series of indicator numerals. This feature permits a saving of time in making the proper adjustment before beginning



Sellers Special Floor Boring, Drilling, and Milling Machine

Milburn Type EF Spray Gun

to spray. Both the dial air-control valve and the calibrated plunger have been made to fit the type E as well as the type EF spray gun.

Eclipse Special Differential-Gear-Mount Internal Tools

Inside bosses on differential gear mounts may be machined with these special internal tools, which have been placed on the market by the Eclipse Interchangeable Counterbore Company, 7410 St. Alban Ave., Detroit, Mich. Several sizes of these tools are available. The multi-diameter cutter shown in Fig. 1 is held inside the malleable casting while the arbor is inserted through it, the arbor piloting in the finished hole above and a bushing below. It rough reams the cored hole, countersinks and faces the bosses for differential side gears.

In Fig. 2 is shown a radius cutter which machines the concave surfaces of the bosses for pinion gears.

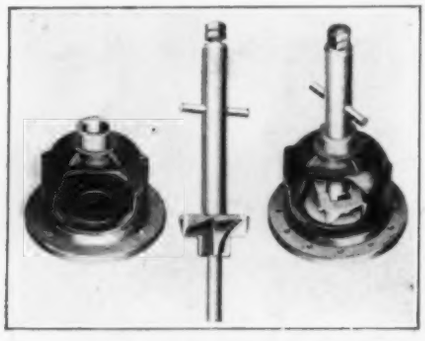


Fig. 1—Eclipse Multi-Diameter Cutter machining side gear bosses

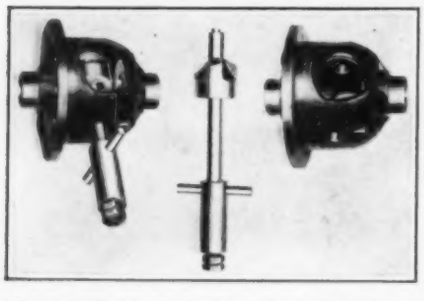
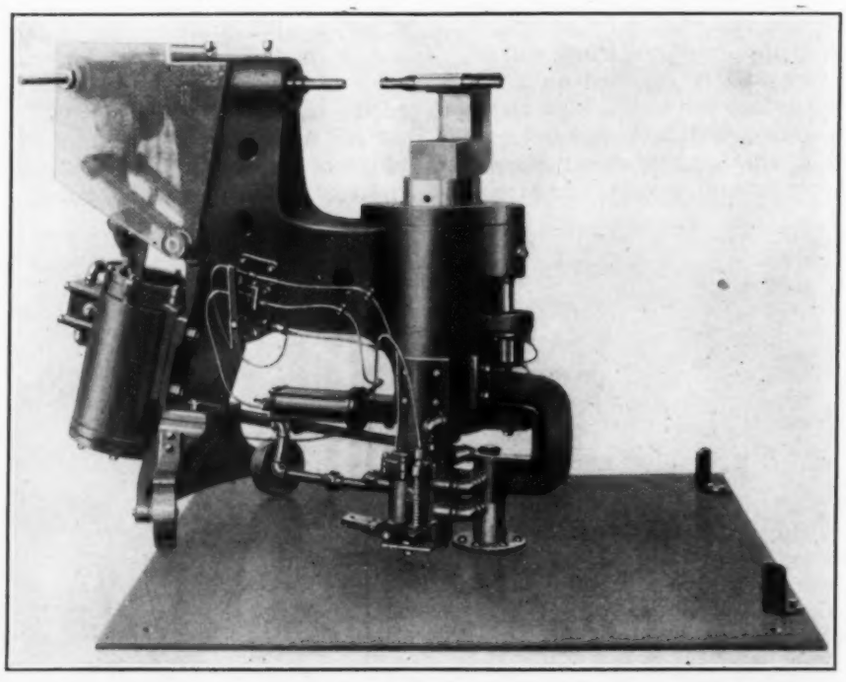


Fig. 2—Eclipse Radius Cutter machining pinion gear bosses

Hanna Web Riveter for Chassis Side Bars

WEB rivets in either side of a suspended chassis frame may be driven by means of this revolving riveting machine which has been introduced by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. The riveter is mounted upon a radially rolling base. The stake, which supports the stationary die, and which enters the interior of the chassis frame, can be rotated about its vertical axis and locked in two positions 180 deg. apart. In addition, the upper portion of the stake adjacent to the die mountings is offset or "goose necked." By indexing the stake the offset is thrown to the right or to the left as desired. By this arrangement a stationary die may be centered upon a rivet joining a channel-shaped crosspiece to the side bar channel web, whether the flange legs at the top and bottom of the crosspiece extend toward the front or toward the rear of the chassis frame. The stake has double die mountings on the one axis so that a die is always in position to oppose the movable die regardless of the stake indexing.

This riveting machine is adapted to truck and pleasure car frames of comparatively low daily production where each machine is required to drive a large number of different sizes of rivets. The riveter illustrated will exert 30 tons on the dies at 100 lb. pressure and will drive hot rivets up to $\frac{3}{4}$ in. and cold rivets to $\frac{7}{16}$ in. It is also made in a 20-ton size.



Hanna Web Riveter for Chassis Side Bars

"Kant-Slip" Open-End Pliers

These open-end, self-adjusting pliers have been introduced by the Kant-Slip Plier & Wrench Company, 428 West 65th Place, Chicago, Ill. The tool, which is adaptable to work

"Kant-Slip" Open End Pliers

in small places, provides a parallel grip for nuts and pipe. A slight pressure on the handles causes the jaws to close by means of a cam wedge action. The available sizes are 7, 9 and 12 in. in length. These pliers are drop forged from alloy steel.

Ideal Commutator Mica Undercutter

Ability to operate in a space 3 in. wide without removing any brush rigging is the feature of this commutator mica undercutter which has been placed on the market by the Ideal Commutator Dresser Company, Sycamore, Ill. The device is driven by

Ideal Commutator Mica Undercutter shown in use

a ¼-hp. motor operating on a.c. circuits at 110 or 220 volts, 60 cycles. It can be used on either large or small commutators of every kind. The device will slot them to approximately ¼ in. from the risers. Worm gearing and small diameter saws make the saw speed comparatively slow, thereby eliminating the tendency to jump out of the slot and gouge the copper bars.

This undercutter has a depth gage placed next to the milling cutter or saw, so that the depth of the cut can be measured readily. It also has a micrometric adjustable guide, which is so constructed that only one slot needs to be cut by hand, as this guide will operate in the next slot. The gear casing is grease tight. The apparatus may be used with the motor suspended at any angle, as it is equipped with a special hanger base and has a thrust bearing. A ⅞-in. milling cutter or saw is recommended. The milling cutter should have a 50-deg. angle, thus cutting a V-shaped slot. In addition to the motor mentioned above, the apparatus consists of a No. 5x4 shaft, a No. 5x4 sheath, the undercutter head, twelve circular saws, the thickness to be specified, or four 50-deg. milling cutters. Motors to suit other circuits can be supplied.

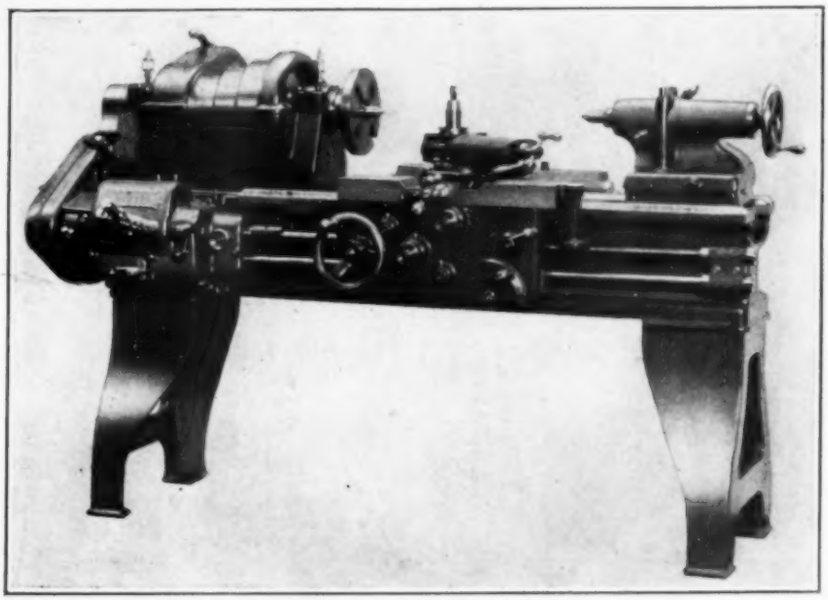
Rockford 16-Inch "Economy" Lathe

THIS cone-head type lathe rated at 16 in., but having a swing of 17¾ in. over the ways, has been placed on the market by the Rockford Machine Tool Company, Rockford, Ill. All sliding surfaces are accurately scraped, and the shafts are turned and ground to size. The carriage has **long** bearings on the bed, and the apron is designed with double walls providing two bearings for each shaft in the same. All gears in the apron are of steel and the compound is of heavy construction.

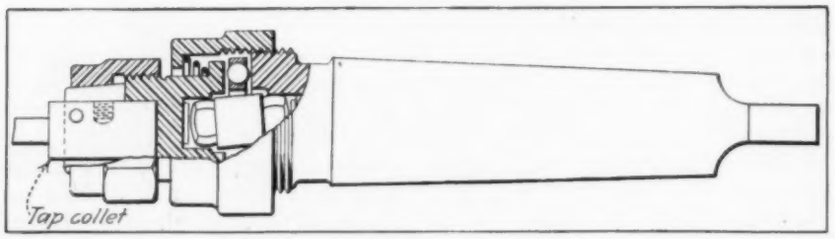
The "Economy" lathe has an individual lead screw for thread cutting and a feed shaft for turning. A simple control is provided which eliminates all possible chance to interlock the two. The head is of the double backgear type which allows the use of a three-step cone and a wide drive belt. A rigidly designed tailstock is securely anchored to the bed and is of the offset type which permits a larger range of work between centers than is recommended. Crucible steel is used for the tailstock center which is ground and lapped into its bearings. All moving parts are completely guarded. The lathe is provided with oil wipers. All standard attachments are easily applied. The lathe is painted in a new shade of blue-gray.

Gairing Full-Floating Tap Holder

Positive drive to the tool while permitting either eccentric or angular motion is the feature of this full-floating tool holder placed on the market by the Gairing Tool Company, Detroit, Mich. The device will drive taps, reamers and other tools. As shown in the sectional view, the tool-holding member is held against the ball thrust bearing by spring pressure caused by tightening a nut. This



Rockford 16-Inch "Economy" Lathe



Gairing Full-Floating Tap Holder

arrangement permits angular motion. The holder is driven by a piece having a rounded hexagon on each end. The ends fit loosely into hexagon recesses in both the shank and the tool holder, and give a positive drive to the tool while permitting a greater latitude of floating movement, either eccentrically or angularly or both, than would be required.

Anderson Horizontal Drilling and Tapping Machine

SMALL parts may be drilled and tapped rapidly on the horizontal machine which has been announced by the Anderson Die Machine Company, Bridgeport, Conn. As shown, it is arranged with a dial plate having 32 openings, but this is subject to requirements. Production is quoted at 60 pieces per hour.

Supported upon a large base casting is a sturdy box column carrying the machine. The apron is of large size to catch coolant and chips, although the latter may be caught in the pan shown in Fig. 1. Four spindles, two drilling and two tapping, are driven by belt from the small motor mounted on the pivoting bracket at the top of the machine. A sector actuates the spindles. Power for reciprocating the spindles and rotating the dial plate is derived from the large motor mounted at the rear. Control of both motors is effected by a pedal operating the starting box.

The dial plate is rotated by a short shaft journalled by the housing and carrying at its other end a segment wheel for indexing. This wheel contains sixteen teeth so that two work pieces are finished at each indexing. It is actuated by a roll cam on the main drive shaft through a reciprocating rod and crank. Should rotation of the dial plate be impeded by an ill-fitting piece, the indexing panel can be lifted out of engagement by means of a lever projecting through the guards. The dial plate may then

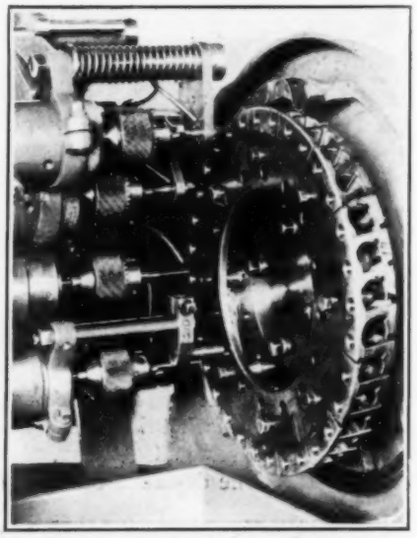
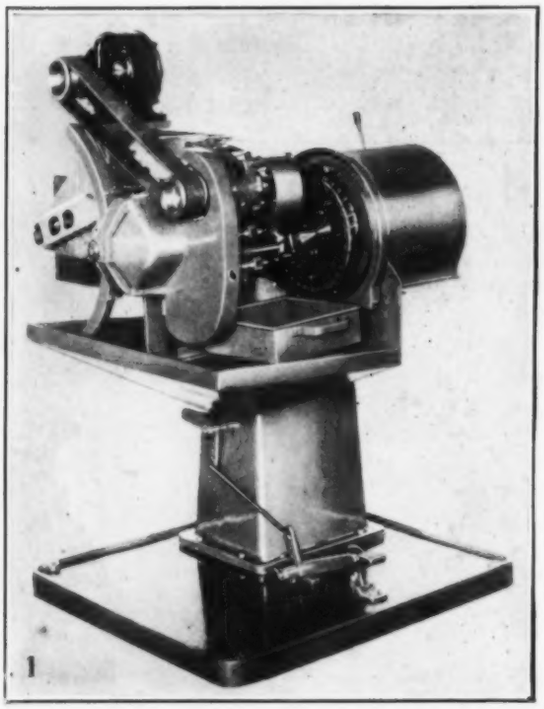


Fig. 3—Close-up of the dial plate and spindle arrangement



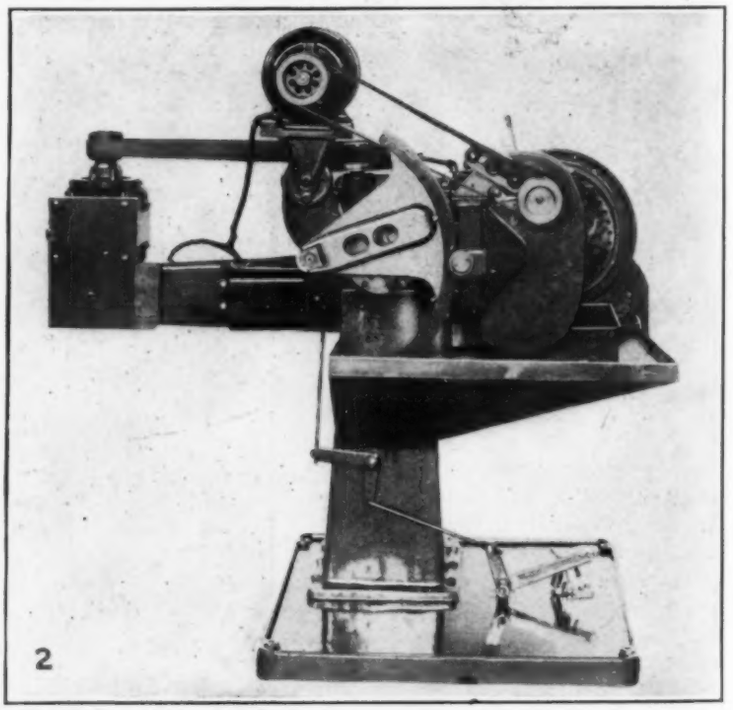


Fig. 1—Front view of the Anderson Horizontal Drilling and Tapping Machine showing arrangement of the spindles and the control. Fig. 2—Side view showing the spindle and main drive in the center actuating the spindle slide

be turned back to any amount.

As the drills advance to the work, they enter special bushings carried by overhead arms. These arms move with the slide. They are equipped with springs so that the pilots on the bushings are pressed into the holes in the hardened steel faceplate and hold the pieces rigidly for drilling. As mentioned previously, the dial plate index mechanism can be thrown out of action. Other safety guards are the stops which will not permit pieces to pass that are not properly seated in the dial openings, and a spring which presses the piece in.

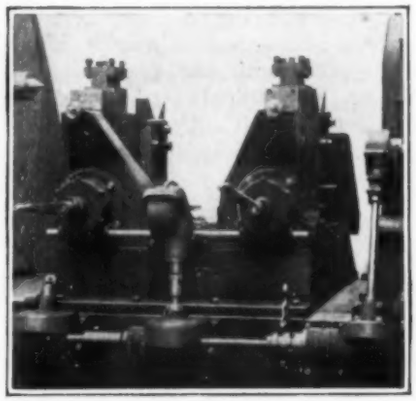


Fig. 3 — Both journals on center-crank axles for 3-cylinder locomotives may be turned at one setting by the use of this special rest

Niles Improved 90-Inch Turning Lathe for Locomotive Axle Journals

CRANK-PIN turning and double quartering attachments have been added to the 90-in. journal turning lathe manufactured by the Niles Tool Works Company, Division of the Niles-Bement-Pond Company, Hamilton, Ohio. Fig. 1 shows the machine equipped with these attachments in addition to arrangements for turning inside and outside journals. This illustration shows the machine arranged to handle wheel sets with a 90-deg. lead only.

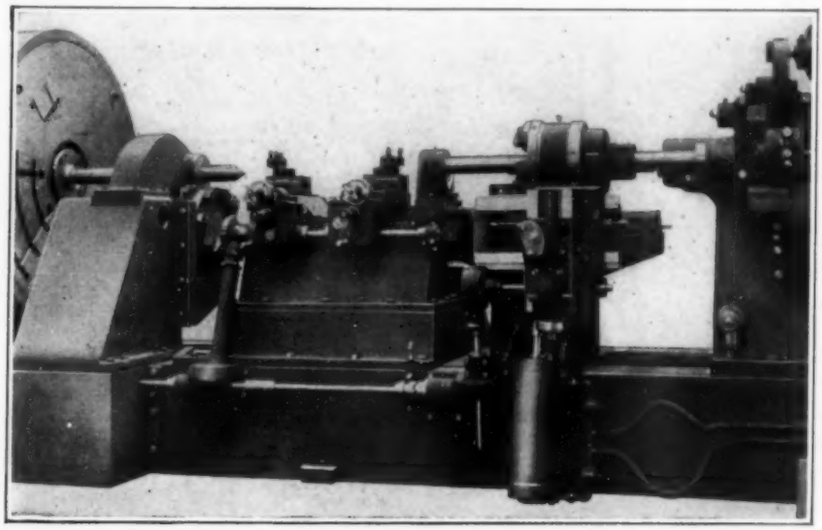


Fig. 1—Niles 90-Inch Turning Lathe for Locomotive Axle Journals equipped with double quartering and crankpin turning attachments

Where it is necessary to double quarter or turn the crank pins of 3-cylinder locomotives having the cranks 120 deg. apart, the right-hand attachment is raised and tilted 30 deg. by means of a filler block as shown in Fig. 2. The filler block may be readily detached to bring the quartering frame back to position for wheels with 90-deg. leads. To support the boring bar for quartering and the crankpin head for pin turning, additional brackets of corresponding height are supplied. These are secured to the members used for the same operations on wheels with 90-deg. leads.

Crankpin heads are of the box-tool type, and are mounted on heavy bases bolted to the bed, the right-hand head on the base to which the outside journal rest is attached, and the left-hand head on an independent base adjacent to the faceplate. The heads receive their rotation and lateral adjustment from the quartering attachment spindles. The capacity of these attachments for engine stroke is the same as for the quartering attachments, namely 22-in. minimum and 40-in. maximum stroke. Crankpin heads will turn pins from 7 to 12 in. in diameter, accommodating pins of the maximum length. Burnishing tools with shanks to fit the crankpin head tool holders are regularly furnished.

Both journals on center-crank axles for 3-cylinder locomotives may be turned at one setting by the special

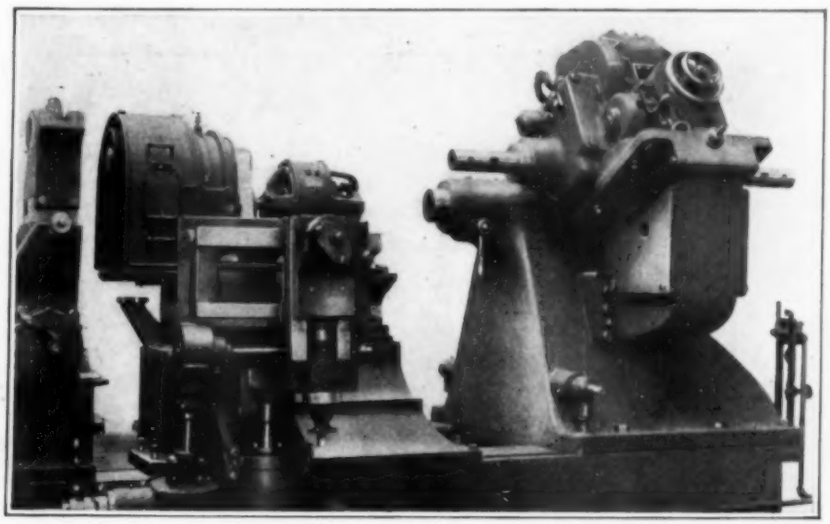


Fig. 2—Machine arranged for double quartering or turning of crank pins of locomotive cranks having 120-deg. leads

rest shown in Fig. 3. This rest has narrow slides, and is quickly interchangeable with the rest. It has power longitudinal feed from the main feed shaft. Cross feed is by hand. Another improvement incorporated in the machine is the use of steel wearing plates on the bed under the sliding heads. These plates are renewable and are the means of preserving alignment between the two heads.

Roll Feed for Cleveland Model M Automatic Bar Machines

RAPID production of pipe coupling blanks or other simple parts from hot-rolled stock, 35 ft. in length, is facilitated by a roll-feed mechanism which has been introduced by the Cleveland Automatic Machine Company, Cleveland, Ohio. The machine shown in Fig. 1 is operated on $1\frac{9}{16}$ in. rods, which are drilled for coupling blanks to use with 1-in. pipe. Operations include drilling, forming the corner of the outside diameter stenciling with the manufacturer's mark and cutting off. The roll feed mechanism is applied to specially adapted automatic, model M, 2- and $1\frac{1}{2}$-in., four-spindle bar machines, designed for four position work, so that four blanks are produced at each feed period. The mechanism also includes a support for the rods, consisting of four housings held by adjustable standards.

The feed rolls are V-shaped, and are mounted on toggle arms as shown in Fig. 2. They are driven continuously by a system of gears actuated by a chain and a sprocket which is geared to the lower cam shaft in the rear. Cams on the same shaft control the action of air cylinders which govern the roll mechanism, and also the gaging and chucking operations. Opening of valves communicating with four air cylinders drives the four pistons which impart a jaw action to the toggle arms carrying the rolls. Each pair closes upon a bar independently of the others, and any variation in the size of one bar does not affect the feed of any other bar. Compression springs back of the finger blocks compensate for any irregularity in the stock. The bars are gaged by four gage stops mounted on the center drive shaft sleeve. After gaging, the stops are withdrawn slightly for chip clearance. At the same time, a sliding shoe, actuated by a drum and cam on the lower shaft, operates four thimbles which close the chucks driven by live spindles. The feed rolls meanwhile release the stock by a reversal of the air pressure which releases the toggle

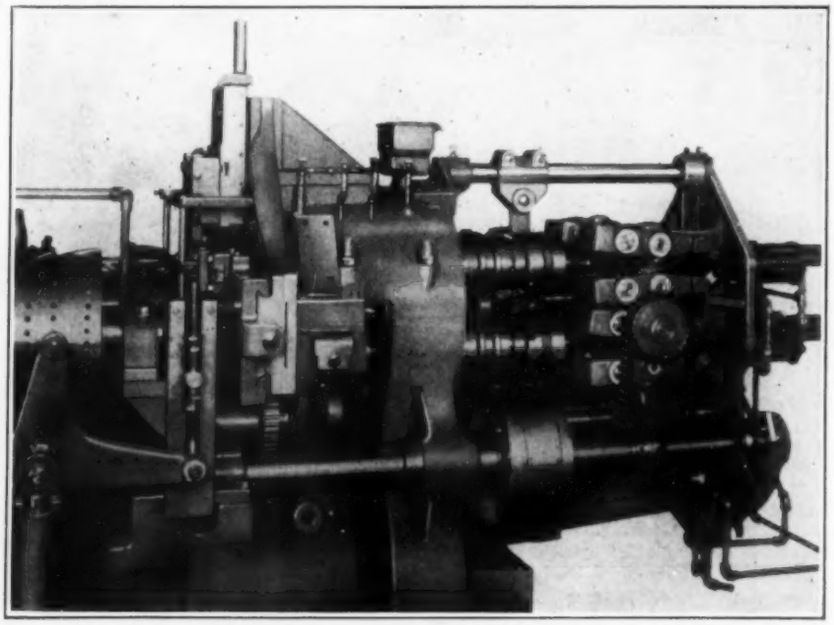


Fig. 2—Geared toggle arms, continuously driven by a chain, cause V-shaped rolls to grip the stock

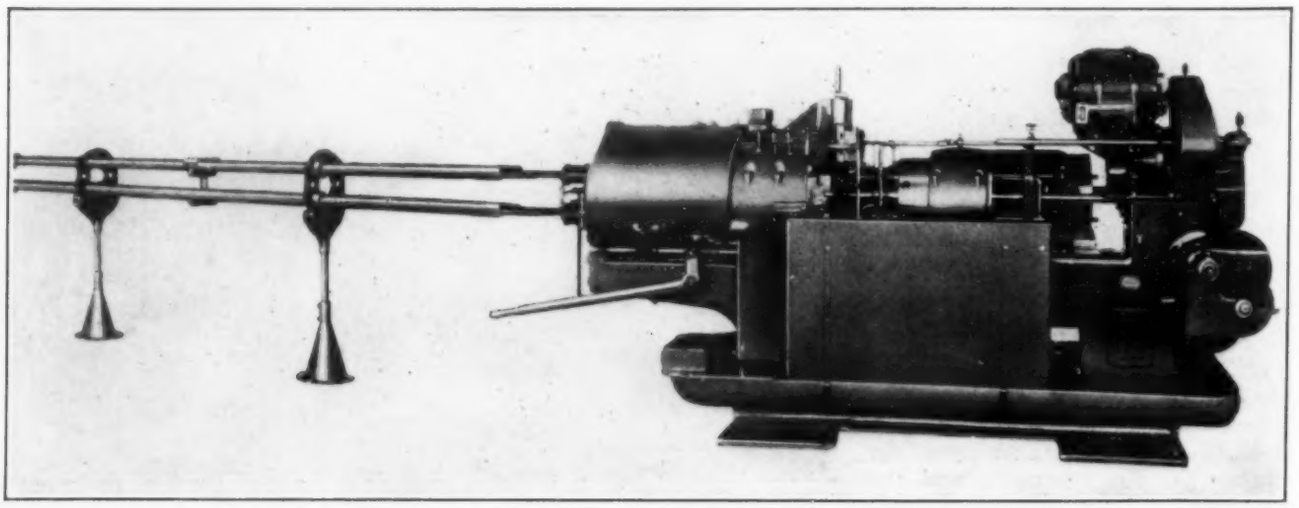


Fig. 1—Roll Feed Mechanism applied to Cleveland Model M Automatic Bar Machine

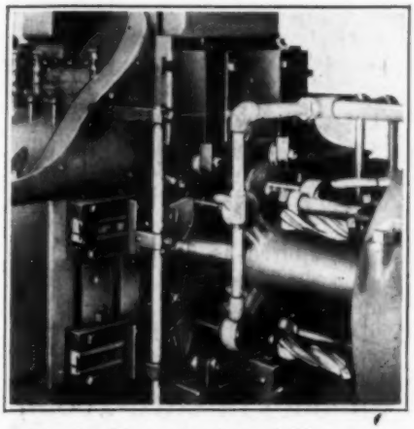


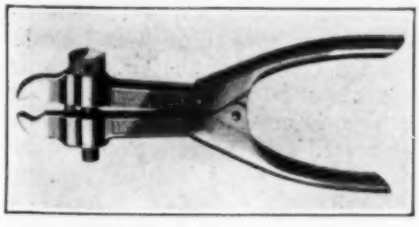
Fig. 3—Close-up of the drills, gage stops, and forming tool slides

arms as the forming operations begin.

Each gage stop has an opening which is of the same size as the drill, as shown in Fig. 3. When the gage stops recede, the turret bearing the four drills advances. The turret is non-indexing. Drilling is accomplished through the openings in the gage stops, so that the latter act as tool guides and strippers as well. Simultaneously, tools mounted on the cross-slides form the corner of the outside diameter, and cut off the blanks. Stenciling is done by four pivoted sectors which advance with the slides and roll the manufacturer's mark into the blanks with a single pass. Stripping four blanks and gaging the stock for the next four is accomplished by a single forward motion of the gage stop. An installation similar to the above, but without the roll feed, has been designed for the manufacture of nuts.

Lawson "Lok-Jaw" Pliers

Compound leverage delivers a 1-ton grip at the jaws of the "Lok-Jaw" pliers made by the Lawson Manufacturing Company, 2720 East 53rd St., Cleveland, Ohio. The tool is designed to fit round, square or hexagon objects. The compound leverage action is obtained by squeezing together the pressed steel handles, which have knurled grips. This pressure is transmitted to the jaws, greatly intensified, by forcing apart the shanks of the tool which is adjusted to the proper size by means of the screw shown. The jaws of these pliers are of forged steel, hardened and tempered. A spring is used between the jaws to keep them open to the desired adjustment. The length of these pliers is 8 in. and the jaws open to $\frac{3}{4}$ inch.

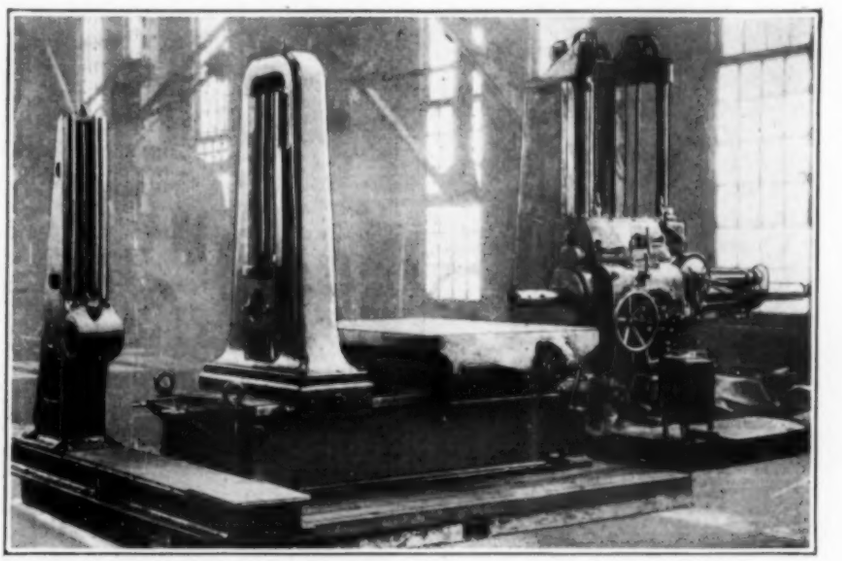


Lawson "Lok-Jaw" Pliers

Ryerson Combination Floor- and Table-Type Horizontal Drilling, Boring and Milling Machine

BOTH large and small work can be machined on this horizontal drilling, boring and milling machine which has been developed by Joseph T. Ryerson & Co., Inc., 16th & Rockwell Sts., Chicago, Ill. This machine is a combination of the floor-type and table-type horizontal drilling machines. The floor-type machine has a single saddle with vertical movement on its column; a column with a horizontal movement on its runway; a bedplate fastened to the runway; and an outer boring bar support, which has a hand movement on the bedplate parallel to the spindle travel. It is direct motor driven, and all speeds, feeds and power traverse to the spindle, spindle-head and column are controlled from the head. The outer boring bar support, as well as the main post, is fitted with vernier and scales reading to one thousandth of an inch.

A special, self-contained portable table, used when machining small pieces, is mounted on the bedplate and can be removed when the machine is used for large work. The table has movements in two directions parallel to the spindle travel and parallel with the column travel. It is operated by hand, but is so arranged that an electric motor can be supplied, giving the table milling feeds and rapid traverse.



Ryerson Combination Floor- and Table-Type Horizontal Drilling, Boring and Milling Machine

Gairing Nose-Driven Reamer

Full floating of the reamer is accomplished by driving it from the nose as in this tool holder which has been developed by the Gairing Tool

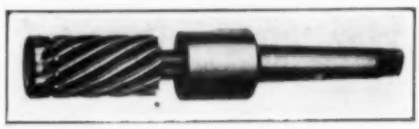


Fig. 1—Gairing Nose-Driven Reamer

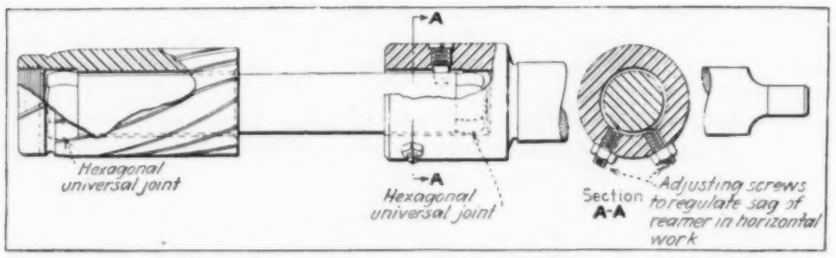


Fig. 2—Cross-section of the Gairing Nose-Driven Reamer

Company, Detroit, Mich. Driving at the nose has the effect of pulling the reamer into the hole, and it is claimed that more accurate following of the hole results.

Nose drive of the reamer is accomplished by using a long driving member extending through the hollow reamer from the tool holder. This driving piece has rounded hexagon ends that fit loosely into similarly shaped recesses as shown in Fig. 2. The driving head is somewhat larger than the hole through the reamer. The screw plug and the washer beneath it hold the driver in place as well as take the thrust of forcing the reamer into the work. The difference between the diameter of the driver and the hole in the reamer limits the float obtainable at this point.

The other end of the driver fits a hexagon recess in the shank and is prevented from pulling out by the screw on the upper side of the shank. Two screws limit the amount of sag of the reamer so as to insure the pilot entering the hole to be reamed. The driving of the reamer is done entirely by the hexagon ends, the screw being used merely to allow the reamer to be withdrawn from the hole.

Canedy-Otto 17-Inch Sliding Head Motor-Driven Drill

DIRECT belt drive from a built-in motor is the feature of this single-spindle drilling machine which has been placed on the market by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill. Power is transmitted from the four-step cone pulley on the motor shaft to a similar pulley on the spindle by means of a belt $2\frac{3}{8}$ in. in width. Spindle speeds are 1,580, 960, 540 and 260 r.p.m. The spindle is mounted in Timken tapered roller bearings, and has a vertical movement of 7 in. The taper hole in the spindle can be either No. 2 or No. 3 Morse. Drills up to $\frac{7}{8}$ in. can be used. Steel tubing is used for the spindle quill, which runs in removable bronze bearings.

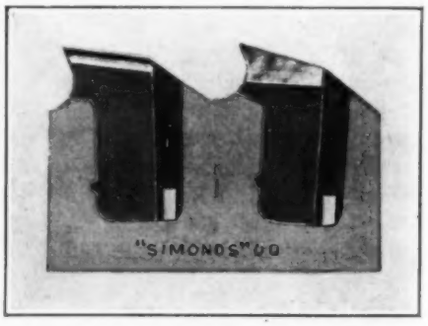
Canedy-Otto 17-Inch Sliding Head Motor-Driven Drill

Both self- and hand-feed types of the machine are available. Either can be equipped with a 15-in. round table which is grooved to permit drainage of oil, or a square table, 14 in. on edge, having three T-slots. The distance from the spindle to the table can be varied from 0 to 31 in., while the distance from the center of the table to the column is $8\frac{1}{2}$ in. The vertical adjustment of the table is 20 in. while the vertical adjustment of the head is 12 in. for the plain type, and $10\frac{1}{2}$ in. for the self-feed drill. Four changes of speed can be had on the self-feed drill, and these can be changed while the machine is in operation.

The $\frac{3}{4}$-hp. motor runs on 220-volt, 60-cycle, a.c., 3-phase. It is mounted in a bracket which slides on its support and acts as a belt tightener, locking in place by a set screw. The floor space required is 16x28 in. With the round table, the net weight of the plain type is 545 lb., and for self-feed type is 610 pounds.

Simonds Inserted-Tooth, Metal-Cutting Saws

Tool steel is used for the inserted teeth of these saws which have been placed on the market by the Simonds Saw & Steel Company, Fitchburg,



Teeth of a Simonds No. 00 "Red Streak" Inserted-Tooth Saw

Mass. These saws are made in seven sizes of teeth, in both light-and heavy-duty styles for cutting materials from soft brass to high-speed steel. The kerfs vary from $\frac{3}{16}$ to $\frac{5}{8}$ in. A section of the No. 00 saw is shown in the illustration. It has wide tooth spacing for thick walls, square or rounds. The kerf cut is $\frac{3}{16}$ in., and the saws are made in diameters of from 10 to 18 inches.

As will be noted in the illustration, the teeth do not all have the same outline. The first tooth is rounded on the top, and is slightly higher than the next tooth. This first tooth engages the work and cuts a groove. The second tooth, which is square on the top, follows through and cleans out the corners of the cut, breaking the chips into three pieces. Fast cutting is achieved through the use of curved gullets which eliminate the danger of metal chips becoming welded to the teeth.

The use of full high-speed steel

teeth in the "Red Streak" saw makes possible high cutting speed, feed and depth of cut, and tests show that high production can be met. The plate of this saw is composed of alloy steel which will stand up under very difficult cuts.

"Hartness" Nos. 8-H and 10-H Automatic Dieheads

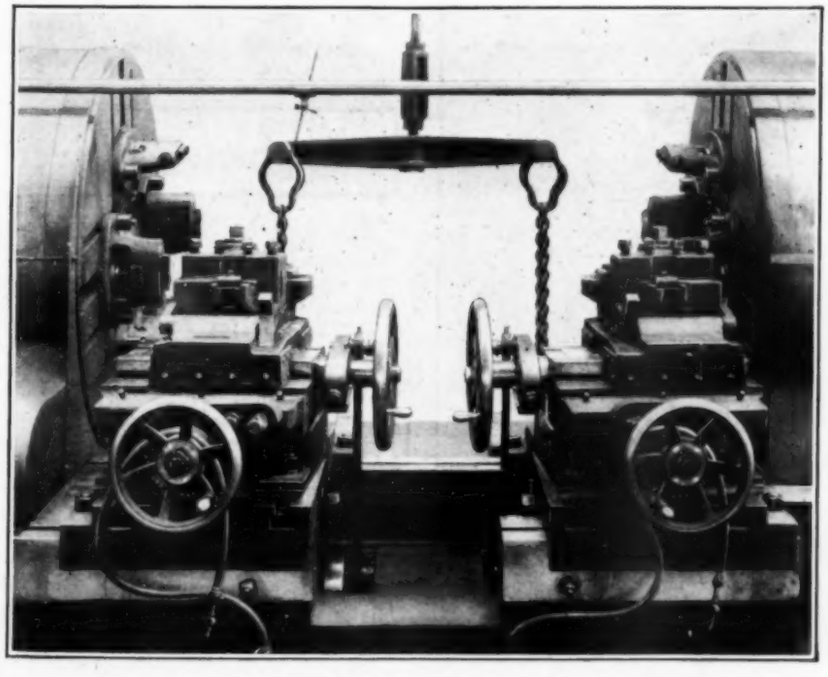
Two additional sizes of "Hartness" automatic dieheads have been added to the line manufactured by the Jones & Lamson Machine Company, Springfield, Vt. The No. 8-H has a capacity from 1½ to 2½ in., while the capacity of the No. 10-H varies from 2 to 3 in. Both dieheads are equipped with chasers made from high-speed steel, ground and lapped in the thread after hardening. It is claimed that the resulting thread form is very accurate.

Hartness Automatic Diehead and Chaser

The diehead itself is finished after hardening by special grinding methods to obtain accuracy commensurate with that of the chasers.

Niles No. 4 Lathe Adapted to Roller Bearing Car Wheels

THE chucking of roller bearing car wheel sets for tire turning may be readily accomplished by this machine, which has been especially adapted by the Niles Tool Works Company, Division of the Niles-Bement-Pond Company, Hamilton, Ohio. The wheels are mounted on centers in sliding spindles, and it is only necessary to remove the end cover plates of the roller bearing housings to expose the centers in the axle. This method of chucking demands some lateral adjustment of the tool rests along the bed to bring the cutting tools opposite the wheel treads, because of the greater distance between face plates. Each tool rest is, therefore, mounted on a sub-base having a small amount of lateral adjustment by rack and pinion.



Niles No. 4 Lathe Adapted to Roller Bearing Car Wheels

Williams-Husky No. 287 Combination Wrench Set for Electrical Work

This combination wrench set for electrical work has been placed on the market through a reciprocal sales arrangement between J. H. Williams & Company, Buffalo, N. Y., and the Husky Wrench Company, Milwaukee, Wis. The No. 287 set combines open-end and socket wrenches for servicing electrical equipment on automobiles and also for use on general electric work. It contains seven Williams' Midget "Superrenches" made of forged chrome-molybdenum steel in sizes of $\frac{7}{32}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{11}{32}$, $\frac{3}{8}$, $\frac{7}{16}$, and $\frac{1}{2}$ in. Each wrench has two openings of the same size, but at different angles, which are 15 and 75 deg. from the center line. These wrenches are light and thin with narrow pointed jaws. They are chromium plated.

Williams-Husky No. 287 Combination Wrench Set for Electrical Work

The eight Husky "Baby" sockets tapered for work in close quarters, and made in sizes from $\frac{5}{32}$ to ½-in. inclusive, are included together with a 5-in. combination T and a 4½-in. handy grip. The latter can be used as an extension.

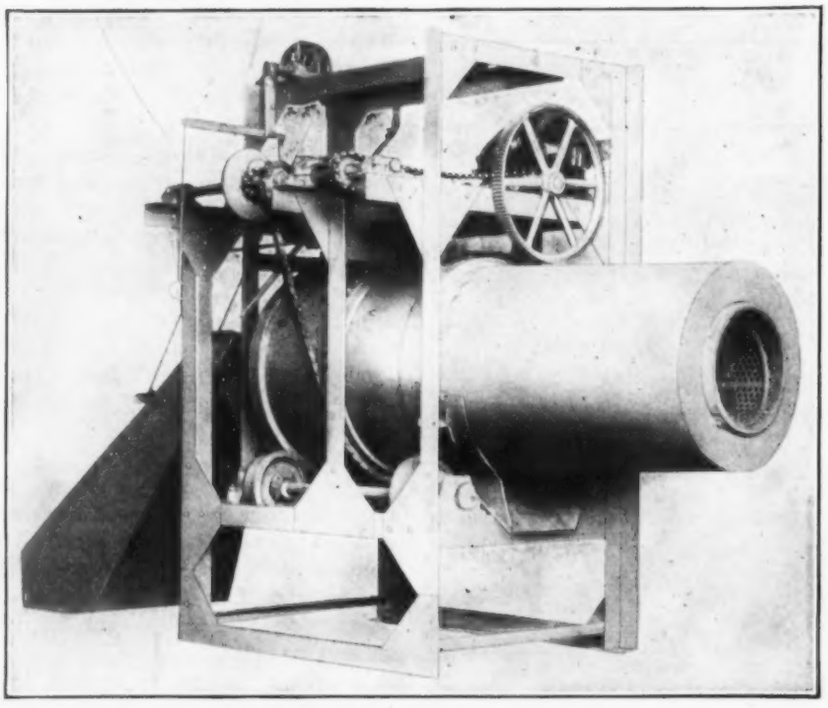
This wrench set is packed in a convenient metal box, 5¼x2¾x1 in. in size. The total weight is 1½ pounds.

Ideal Star-Return Tumbling Barrel

THIS machine for tumbling drop forgings, heavy stampings and castings has been developed by the Ideal Industrial Machinery Company, Division of the Consolidated Concrete Machinery Corporation, Winton Place, Cincinnati, Ohio. The parts are tumbled with stars or slugs, together with flint shot, silica sand or steel shot, using a weight of stars approximately equal to the weight of parts to be handled. In tumbling the work with this proportion of stars and sand the parts are prevented from touching each other and acquire a finish which is claimed to be undistinguishable from that produced by a sand blast. Furthermore, the scale is removed from alloy steel forgings without denting the work and without destroying the corners on the parts.

The labor involved in handling work in this barrel is small. The parts are charged into the machine by means of the power loader shown, and tumbled in the barrel with the stars and sand. In order to discharge the work, the direction of the rotation of the barrel is reversed. This action automatically discharges the work at the end of the screen. The stars and sand are separated out and fall into the cone-shaped jacket surrounding the screen. When the barrel is again rotated in the tumbling direction, the stars automatically return to the tumbling compartment. This transfer and separation of the stars is accomplished by means of a patented cup arrangement of simple and rigid design. This cup is placed in the head between the tumbling compartment and the cone surrounding the separating screen. The barrel is equipped with an exhaust hood for connection to standard exhaust systems.

These machines are built in sizes of from 24x18- to 48x60-inch tumbling compartment, and are constructed to stand hard usage.



Ideal Star-Return Tumbling Barrel

Trade Catalogs

DIE CUSHIONS. The Marquette Tool & Manufacturing Co., 1900 N. Kilburn Ave., Chicago, has issued its 1928 catalog, describing Marquette pneumatic and hydropneumatic die cushions, as applied to the drawing of metal and miscellaneous stamping operations. Known as catalog No. 4, it contains 151 pages, 6½ x 9½ in., with cloth-board covers. Of special interest to those engaged in sheet-metal manufacture are many examples showing the application of die cushions to different types of drawing and forming dies. The compilation of information and engineering data is the result of research work conducted by an engineering department that has made a specialized study of the deep drawing of metal. Many useful tables are included, such as the weight of sheet-metals, areas of drawn shells, blank diameters of cylindrical shells, and the strengths of metals.

FLEXIBLE COUPLINGS. Smith & Serrell, 20 Washington Place, Newark, N. J., have published Bulletin No. 37 showing the line of "Francke" flexible couplings for direcct-connected machines. Many different types of drives are shown equipped with these couplings. Directions to follow in selecting sizes are included. Specifications and keyway sizes for various bores are given. The catalog contains 32 9x6-in. pages.

SHEET-METAL WORKING MACHINERY. The Niagara Machine & Tool Works, Buffalo, N. Y., has published Bulletins Nos. 64-C and 68 on machines and tools for sheet-metal working. The first shows several types of power presses, series No. 60, and gives specifications thereof. The latter describes foot and screw presses, the foot presses being in straight, inclinable and horn types. Each press is illustrated, and specifications are given.

SPROCKETS AND CHAINS. The Boston Gear Works Sales Co., Norfolk Downs, Mass., has published a catalog showing sprockets and chains which are standardized for immediate delivery. It gives suggestions for the selection of this equipment and includes illustrations of various types and tables of the sizes. Of particular interest is the roller chain selection chart. Other items shown include drip-feed lubricators and adjustable outboard bearings.

Pamphlets Received

STRENGTH OF UNDERSIZED HEXAGON NUTS.—The department of Scientific and Industrial Research has published Special Report No. 7, entitled "The Strength of Hexagon Nuts of Less Than Standard Size for Bright Steel Bolts," by C. Jakeman, National Physical Laboratory. This report deals with experiments made to determine the safe reduction in size of bright hexagon steel nuts for use on bright machined bolts clamping together machine surfaces. It is shown, in general, that the minimum size of nut is that in which the bearing surface of the nut face is equal to the core area of the bolt. Copies may be obtained from His Majesty's Stationery Office, Adastral House, Kingsway, W. C. 2. London, England, for 1s. 3d. net.

NEWS OF THE WEEK

Large Gain in Exports of Metal-Working Machinery in 1927

Exports of metal-working machinery from the United States in 1927 reached the largest volume in seven years, or since the abnormal post-war year 1920. The total value of these shipments was $25,379,000, or 35 per cent more than during 1926 and greater than the volume of 1925, which had marked an abrupt increase over previous years. The marketing of this large volume of equipment is of especial interest inasmuch as metal-working machinery is in demand only in those countries that enjoy a certain degree of industrial development. The principal markets for this class of machinery are therefore to be found among the most highly industrialized nations and consequently among the very countries that are the keenest competitors of the United States for the world's metal-working machinery trade.

The outstanding development in the foreign metal-working machinery trade was the gain of $5,000,000, or 50 per cent, in shipments to Europe. The decline in these exports to Europe in 1926 was responsible for the poorer showing of that year as compared with 1925, but this loss has now been more than regained. Europe in 1927 absorbed twice as much American metal-working machinery as in 1924 and three times the total value of 1923. As a result of these gains, Europe in 1927 imported 57.5 per cent of the total United States exports of this class of machinery, or 6.1 per cent more than in 1926. Latin America, on the other hand, imported only 10.4 per cent, or 4 per cent less than in 1926.

Great Britain and Canada continued the largest individual markets for United States exports of metal-working machinery, imports into each of these countries increasing by more than $1,000,000 over 1926. Germany, whose purchases had fallen off about 67 per cent in 1926 from the record purchases of 1925, imported more than three times as much metal-working machinery in 1927 as in the previous year. Imports into France showed a substantial gain over 1926, but did not quite equal those of the previous year.

Social Research Needed to Stabilize Industry

That mass production is insecure for both labor and capital because of its dependence upon wide markets, and that social research and scientific management under the joint auspices of labor and employers are needed to give stability to industry and to protect wage earners against those effects of mechanization that are detrimental, was pointed out by speakers from the United States, Great Britain, Germany and other countries at the Congress of the International Industrial Relations Association (for the study and promotion of satisfactory human relations and conditions in industry), held at Cambridge, England, June 27 - July 2. "Fundamental Human Relationships in Industry," was the subject discussed. The congress was attended by personnel managers, welfare workers, employers, representatives of labor, factory inspectors and research workers.

Summing up the proceedings, Miss Mary van Kleeck, director of the department of industrial studies, Russell Sage Foundation, New York, said: "The well-being of workers in all countries depends upon the underlying economic conditions which to-day present certain common problems, especially the growth and movement of populations, the need for wider markets for the increasing output of mechanical industry and the problem of securing raw materials. To insure a status for wage-earners which is in accord with the dignity of the human being, there is needed participation by workers' organizations jointly with employers' groups not only in the management of one establishment but in determining the larger economic policies of industrial life. Even more important than the material factors is the mental attitude of groups towards one another, the establishment of understanding being essential."

The Officers of the International Industrial Relations Association elected for the ensuing three years were: President C. H. van der Leeuw, Holland; vice-presidents, Miss M. van Kleeck, New York; Miss M. L. Fleddérus, Holland, and Erich Lübbe, Chairman of the Works' Council (employees) Siemens Ltd., Berlin; treasurer Charles E. Jacob; managing director, Messrs. W. and R. Jacob and Co. Ltd., Dublin.

Hacksaw Blade Simplification Accepted

A sufficient number of signed acceptances have been received from producers, distributors and users of hacksaw blades to insure the general adoption by the industry as a whole of the proposed Simplified Practice Recommendation No. 90, which is now declared effective as of July 1 by the Department of Commerce. This date applies for new production: Jan. 1, 1929, is the date set for current stocks.

Obsolescence of Machines To Be Studied

The Department of Commerce is about to undertake a requested study of industrial equipment. One of the objects of this study, which will be conducted by the Domestic Commerce Division, under direction of H. C. Dunn, is to determine the amount of obsolete equipment and its importance as a factor in the inability of firms manufacturing similar products to compete on an equally profitable basis.

Replacement of machinery that in point of service may have many years of usefulness, but that in point of satisfying the latest fancies of the consumer market is obsolete, is an important matter for the manufacturer and one which is behind the request for the survey to be made by the Department. The following statements by Mr. Dunn explain the object and plans for the survey.

"The practical value of this study would probably be a truer accounting for obsolescence as a hazard rather than as an arbitrary compromise with depreciation as at present. Wear and tear, or depreciation, is a scientific measurement and can be determined accurately in cost accounting. Obsolescence is analogous to fire as a risk. It cannot be determined any more than the date a building will burn can be determined. An arbitrary basis of accounting for the two factors does justice to neither, and fails in adequately providing a fund for replacing machinery when its value has been destroyed by its being worn out or rendered obsolete.

"It would seem that there would be two important phases of the industrial equipment study; one to bring out facts that show obsolescence to be an important factor in production costs; and another the importance of correctly evaluating and providing for obsolescence in cost accounting.

"The first result would probably best be attained by a comprehensive study of the history of specific machines, such as milling machines and planers. The second phase of the study would involve the enumeration of the machines in the users' plants of whatever industry or industries selected. The census of the machines in use would probably include such questions as the type, model, and size of the machine, floor space occupied, the productivity of the machine, age of the machine, power consumption, repairs and rejects of its product. These items are tentative as yet, and the final questionnaire will be decided upon after study by the advisory committee."

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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THE statement of the Federal Reserve Bank of New York shows a decrease of hardly more than 1 per cent in brokers' borrowings and the advance in interest rates is gradually working the inevitable effect. The declining tendency was however punctuated by occasional reactions that were caused by short covering or buying by those whose confidence in an early resumption of the late boom still persists.

But most of those whose judgment is not colored by their commitments admit that a further reduction in security loans is necessary to restore the poise of the money market, and that a general liquidation of the securities pledged against these loans is to be expected. Perhaps this view is more generally accepted in the bond market than in the stock market, for the decline in bond values has involved many high-class issues, and even government obligations are from 2 to 4 per cent below the year's highest prices.

There have been some sensational declines in the stocks of certain banks and insurance companies that had advanced sensationally, but the trading in these issues has been comparatively small, and quotations for the great mass of investment securities are still within measurable distance of the top. From this statement, opposing conclusions may be drawn, and there are some who maintain that the low prices reached on February 20, 1928, represent the irreducible minimum of the present era. But most bankers dissent from this view and the reasons for their dissidence are interestingly set forth in a dispatch from Chicago which appears to reflect the attitude of the Federal Reserve officials.

Briefly, this dispatch says that Chicago's insistence upon higher interest rates is based:

First: Upon the speculative distention indicated by the borrowings reported by members of the New York Stock Exchange.

Second: Upon the country-wide speculation in unlisted securities as a result of which "many banking institutions have gone as far as prudence will allow in making loans to carry the stocks of affiliated corporations, such as banks, insurance companies, investment trusts, and finance companies."

Third: Upon the volume of speculative building in the face of figures that show that the unrented space in apartments and office buildings now averages 12 per cent as against a normal of from 4 to 6 per cent.

This is the case for the deflationists. They may be wrong, and they will always be unpopular, but it must be admitted that precedents support their conclusions. But stocks of merchandise are so small that the predicted liquidation is not likely to extend beyond the securities market, and for this reason what is called "general business" is in an exceptionally sound position.

Taken in their entirety, the crops promise at least an average yield. The fruit crop in particular is excellent and its importance is not appreciated. Of corn, it is too early to speak with any certitude, but it seems certain that the increase over last year will more than offset the decrease in wheat, which is estimated at about 80,000,000 bushels.

Cotton is just entering what may be called the hypercritical period, but the gain in acreage reported by the government has somewhat reassured those who might otherwise be fearful of the deterioration that is normal during July and August. But upon the whole, the value of the prospective crops at present prices exceeds last year's. Therefore the purchasing power of the farmers should be undiminished and the distributive trade of the country appears to reflect this expectation. Hand-to-mouth buying is, however, still the fashion, and as the manufacturers are left to "hold the bag" they continue to talk of overproduction.

This so-called overproduction is, however, due to the elimination of the stocks that the middlemen used to carry. And as a return to the old regime is unlikely, some plan that will enable manufacturers to adjust themselves to the change will have to be evolved. In the cotton goods trade, where stocks are being reduced by short time operations, something of this kind appears to be now going on, and it may be that a similar procedure will have to be followed in other industries. If so, business in the end will be benefited, for the old system involved a good deal of waste and expense that is preventable.

Outside of the cotton goods trade, a distinct improvement in business was noticeable last week. Car loadings ran ahead of last year for the first time in several months. A better demand for steel at higher prices is reported, and the automobile people claim to be selling more cars at the lower prices announced by some manufacturers.

Most building materials, including copper, are in excellent demand, and a continued decrease in unemployment is reported. Commodity speculation is at a low ebb. Cotton futures declined upon a supposititious improvement in the crop outlook, and sugar has made a new low for the year in the face of conditions which seem to point to higher prices.

But, barring the crop outlook as affected by the weather, there is nothing to incite speculation in agricultural products at present, and it seems safe to predict commercial normalcy, at least until after the election.

WHAT'S DOING IN INDUSTRY

NO PRONOUNCED seasonal dullness in the machine tool market is felt in most parts of the country, with the exception, perhaps of Indianapolis and Detroit, where the dullness reported last week still continues. There has been a noticeable increase in inquiries, however, and automobile manufacturers are beginning to line up their fall purchasing programs. Ford, of course, is still buying. Conditions in the Chicago and New York markets are much alike in that machine tool activity is surprisingly good for this period, and for many July business will probably exceed that of June. In both places railroad buying is largely anticipated rather than actual.

RAILROAD buying is quiet in Indianapolis, and general tool business is dull due to a hesitation on the part of buyers to close on orders. Some purchases are expected from automotive plants in the near future, however. New England reports conditions satisfactory with no startling activity, except in small tools for which there is a good demand. In the South, machine tool business is on the upward trend, being much better than anticipated. Canada also finds a continued steady demand for equipment and the metal-working industry is at capacity, particularly automobile manufacturers.

AERONAUTICAL engine firms lead in buying in the northeastern states, while in the Middle West and in the South, manufacturers of farm machinery, road building and contractors' equipment are in the market. While metal-working activity is fairly general, small shops should not be included in this category.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW ENGLAND

The past week, in so far as its relation to the machinery and machine tool industry is concerned, has been practically devoid of features in the New England section. Inquiries were comparatively few and no large orders were placed. The industry, to all appearances, seems well satisfied with the present status of business, however, and is content to anticipate a livelier market following the mid-year vacation and inventory period. Representative dealers, while not crowded with orders, find the demand for small equipment well above the usual July. Grinding units are selling well.

During the week the Boston Schoolhouse Department closed on its final list of machine tools. The city of New Haven is expected to be in the market shortly for a sizable list of metal-working tools for the vocational department of its proposed Junior high school, and New Bedford is also a prospective buyer to equip a vocational machine shop.

The aeronautical industry is representative of a good share of New England activity, especially in Connecticut. Additional orders for engines have been received by the Pratt & Whitney Aircraft Co., Hartford, to equip planes for the proposed air line to Montreal. Plans are underway at Bridgeport to build a Balanca passenger plane for a proposed South American trip with a view to developing a market for the product in South America. The Indian Motor Cycle Co., Springfield, is planning to manufacture a new high-priced small automobile; plans for which are yet in the initial stages.

CANADA

Manufacturers of machinery and machine tools in Canada report a continued steady demand for their products, with inquiries from all sources indicating a busy season ahead. Practically every branch of the metal-working industry is working at or near capacity, and most plants report sufficient orders on hand to keep them well employed until the fall. The principal recent developments have been the placing of third-quarter contracts, and it is estimated that at least 60 per cent of the regular contract buyers have closed contracts at prevailing prices sufficient to cover their needs up to the end of September.

Conditions in the automotive industry are very encouraging. Output is steadily increasing and latest government figures show that there is a growing demand in foreign countries for Canadian-made cars. Structural steel business is active. In practically every large center in the Dominion there are a number of big stores or office buildings being erected. The report of building permits issued during the month of June showed the highest total in the history of the Dominion.

Much new business is being placed by electrical equipment manufacturers. This branch of the industry is enjoying a high degree of prosperity due to requirements for the numerous hydro-electric developments at present under way in various parts of the country. It his been estimated that hydro-electric installations this year will total 550,000 hp. This is the amount of turbine capacity which is being installed in entirely new developments or in additions to existing hydro-electric stations.

DETROIT

Conditions in the machinery and machine tool market here have changed very little from the dullness reported last week, except that a number of good inquiries have come in for material for future delivery. There is still some buying, however, particularly in the field of specialized equipment.

Most of the motor car manufacturers are planning changes, and many of them are holding up on their orders until after the summer vacation period. Chrysler is getting a favorable reaction on its new line and will probably go into heavy production soon. Ford is still buying and still stepping up production. The General Motors plants are making plans for changes and for expansions within the very near future. Oakland, Chevrolet, Oldsmobile, Buick and Pontiac are all very active.

The small shops are not as busy as they have been, but are by no means idle. The general level of prosperity is still high, and big things are expected in the machinery field between now and autumn.

CINCINNATI

The majority of the machine tool manufacturers in the Cincinnati district report that while the market has been somewhat quiet in the past week they have done better than to hold their own. Sales departments are going on their vacations, and buyers are doing likewise, and therefore it seems logical to expect a gradual tapering off of business for awhile, is the opinion expressed.

Selling agents report that the demand has been better than fair the past week, considering the season, especially in adjacent territory to the north. The fact that their representatives and also their prospective customers are on vacations has a tendency, of course, to reduce the volume of sales.

A large sale reported in the week is the booking of a railroad order that calls for fifteen lathes. The principal buyers were general machinists and miscellaneous users, well scattered over the country. The majority of the orders received were for single tools and replacements and the requirements were well diversified in the matters of sizes and types. Several single orders came from automobile manufacturers and a fair-sized list of small tools was made to a concern in the allied automotive industry. One manufacturer of machine tools bought some replacements.

The majority of the manufacturers report the receipt of a good volume of inquiries in the week, the great majority of which were in regard to single tools and replacements. The principal inquirers were general machinists and miscellaneous users, well distributed over the country, whose requirements were well diversified assortments of single tools and replacements.

CHICAGO

A slight letting up of business in the machine tool industry has been reported for the last week by some dealers and manufacturers' representatives. In the main, however, market conditions generally are declared to be surprisingly good, and July business promises almost to equal that transacted in June, which was close to a record month for recent years. Interviews with district agents representing certain lines of tools reveal an exceptionally satisfactory situation with respect to trade. At the sales office of a midwestern plant whose principal output is screw machines, it was stated that the volume of business in its product since April has been the largest for a like period in ten years, and that the resources of the plant are being taxed to keep pace with the demand. Small electrical tools are selling in increasingly good volume. Demand for punch presses is reported as unusually active for midsummer. Some new inquiries for single tools and small lots have been received from railroad sources. Business in used tools is reported to be fairly good, and inquiries for this line of equipment indicate that the fall trade will go ahead of that of last year.

SOUTHERN DISTRICT

Since the early part of July, the machinery and machine tool business in the southern district seems to have been on an upward trend. The volume is reported by dealers to have held up on a satisfactory basis with a number of fair orders booked, and the outlook is better than it has been in four or five weeks, judging from the tone and volume of present inquiries. For the first half of the month, in fact, sales have been better than they were the last half of June, and are reported especially active at this time in some of the industrial fields. Every indication is that business will be better during the summer period than most dealers had thought a month or so ago.

Woodworking machinery business has shown a revival and sales are again reported better than normal as they were during the first four months of this year, with active inquiry from the furniture industry, which continues to be the largest buyer. The best business is reported in Georgia, East Tennessee and Carolina.

Some scattered orders of fair size are reported for road-building and maintenance equipment, while contractors' machinery continues active in nearly all of the larger southeastern cities, where unusual building progress is being made, but is reported relatively quiet in the smaller towns and cities. Railroads are placing some good orders for heavier equipment for shop building projects under way in the South, and business also continues brisk in the textile mill field. Smaller machine shops and garages, however, are buying but little, most of their orders being for used or rebuilt equipment.

NEW YORK

Business in the machine tool market in New York still remains at a high level, despite the hot weather and the interference of vacations taken by those who buy or specify equipment. Although at this writing the month is only two-thirds over, more than one dealer predicts that the number of orders received this month will be greater than for the previous month, which for these particular concerns had represented a slight drop from the general level maintained during the spring. For only one dealer was a decided drop in demand noted, and with the number of inquiries out and the amount of business pending, no great falling off is expected during the summer months.

Purchases, being either made or contemplated by the Wright Aeronautical Corporation and the General Electric Co., are responsible for the greater part of the volume of business received by many, although general demand also is holding up. It is understood that during the past week the Wright concern bought a number of K. & T. Mil-Waukee-Mils, Cincinnati millers and cylindrical grinders, Norton crankshaft

grinders, Landis camshaft grinders, a Cincinnati planer, and a number of Gridley automatics. Although it is reported that there is a general exodus of machine tool factory men from Paterson, several local dealers are confident that the buying there is not over and that much business will come from this source for some time. The General Electric Co. is said to have purchased a number of large presses in the past week.

Several dealers report purchases by the Otis Elevator Co. in the past few weeks, and the Presbyterian Hospital bought a number of items for a maintenance shop, including an 18-in. Sebastian lathe, a 20-in. Buffalo drill, a 10-in. Buffalo, Jr., drill, and a Racine power hacksaw. Small tools, including chucks, and grinding wheels are finding a good market in this territory, indicating activity in the metal-working shops. Railroad buying is practically nil, but is expected to materialize before the month is over.

Among the machines sold by the Pratt & Whitney Co. during the past week were: A duplex hobber, a 13-in. lathe, a 16-in. lathes, a 7-in. bench lathe, two No. 3 bench miller, three 9½-ft. and one 13-ft. deep-hole drillers, a double-singlde Sigourney drill, a 6- and a 12-in. vertical shaper, and two No. 2 jig borers. The Niles Tool Works Co. sold a 90-in. journal turning machine to a railroad in the West, a 3,500-lb. steam hammer, and an 18-in. slotter. The former company reports plenty of business pending to make the outlook satisfactory.

INDIANAPOLIS

Little change is seen in the machine tool or machinery business here. The mid-summer dullness is enlivened only by a few inquiries, but orders are hard to close. There are some encouraging signs, however. One of the disappointing features of the present year has been the indifferent demand from the steel industry, particularly the structural steel factories. Lack of building in many sections is said to have accounted for this lack of demand for machinery.

With the return of the furniture executives from the mid-summer shows in Chicago and Grand Rapids, some slight increase is expected in the demand for woodworking and special machinery for this industry. The outlook is not so good, however. Demand from other wood-working factories, particularly sawmills and hardwood flooring factories, has also been disappointing, though there has been some equipment sold to sawmill operators.

Some small lathes and grinding machinery are being sold to the garages scattered about this territory, but here again the demand is not up to expectations.

A little later in the summer there should be some demand from the automobile industry. Already the local Marmon plant is placing men back to work after a couple or three weeks' suspension, and is reported to be working on a new model. The Chrysler and Studebaker plants are buying only their absolute requirements, but fall trade should be a little better.

Demand from the farm implement factories remains very quiet. Fall will see these plants back in operation on a much larger scale, however. Some demand is being noticed from the railroads, but the general policy is to curtail purchases to a minimum.

Steel and Wrought Iron Pipe Nipples Standardized

A general conference of manufacturers of pipe and pipe nipples, distributors and users of pipe nipples, held June 29, under the auspices of the Commercial Standards Unit, Bureau of Standards, approved commercial standards for steel and genuine wrought-iron pipe nipples. The standards specify that pipe nipples shall be made only from tested new full or short lengths and full-weight steel pipe, free from buckles, bends, kinks, cracks, laminations, imperfect welds, rust, injurious sand marks, or any other defects which might affect its strength or serviceability.

For steel pipe nipples, the pipe shall otherwise conform in all respects with the A.S.T.M. tentative specifications for welded and seamless steel pipe, while that for genuine wrought iron pipe nipples shall be in accordance with A.S.T.M. Specification No. A72-27 for welded wrought iron pipe.

The conference agreed that the effective date for new production and clearance of existing stocks should be January 1, 1929. The conference voted unanimously for the adoption of the certification plan of the Bureau of Standards. Under this procedure, the manufacturer of the nipples will, upon request, certify to the purchaser that his commodity is made in conformity with the approved Commercial Standards.

A.S.M.E. Summer Meeting and Boat Trip Includes Varied Inspections

The first delegation of members of the American Society of Mechanical Engineers will leave Buffalo by steamer on August 20 for the summer meeting of the Society at St. Paul-Minneapolis, beginning August 27. Calls will be made at Cleveland, and again at Detroit, where a 4-hour inspection of the leading automobile plants has been arranged.

Mackinac and Sault Ste. Marie are the next ports of call, with a detailed inspection of the Soo Locks planned for all members. Opportunity for inspection of the Superior Copper Country has been provided for at Houghton, with trips to several mines.

The Duluth Engineers' Club, and the Engineers' Club of Northern Minnesota are acting as hosts to the Society at Duluth, where the Mesaba Iron Range may be visited. The delegation will arrive in Winnipeg in time to participate in the joint meeting of the Engineering Institute of Canada and the Minnesota Society.

The program at St. Paul-Minneapolis includes a dinner on August 29, at which T. D. Campbell, prominent in farming on an industrial scale, and Ralph Budd, president of the Great Northern Railroad, will be the speakers.

The technical program offers an opportunity for discussions of various subjects. Papers on applied mechanics include the following: The Evaluation of the Technical Worth of a Steel from Physical Test Data, by A. B. Kinzel; and Stress Analysis in Electric Rotating Machinery, by M. Stone. On apprenticeship two papers will be presented: The Apprentice-Training Program of the Tri-Cities Manufacturers, by S. M. Brah; Does Mass Production Lessen the Need for Trade Skill? by H. A. Frommelt.

The discussion on agriculture includes a paper on the Mechanization of Agriculture, by E. A. Stewart.

Western Metal Congress Plans Progressing

During the week of January 14, 1929, at Los Angeles, in conjunction with the Western Metal Congress, there will be five days of technical sessions on subjects pertaining to the making, working, treating and use of metals. The program for this congress is now being worked out by a committee representing the associated societies.

Other technical societies and associations will participate in the preparation and presentation of the papers including the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the Institute of Metals, the American Welding Society, the Society of Automotive Engineers, the Metal Trades and Manufacturers Association, the National Purchasing Agents Association, and the American Society for Steel Treating. Several of the above associations and societies have plans for holding their regular yearly sectional meetings of their western groups or divisions in Los Angeles during the Congress and Exposition.

The congress is to be the most important conference ever assembled in the interest of the educational advancement of the metal industry of the western states.

Concurrently with the Western Metal Congress there will be held for five days at the mammoth Shrine Auditorium in Los Angeles, with 101,000 sq.ft. of floor space, the first metal and machinery exposition ever held in the West. This exposition will represent a complete cycle of the metal industry from raw material to finished products, including a machine tool shop with the latest tools; heat-treating equipment; inspection and testing equipment; foundry equipment and supplies; material handling equipment; welding and cutting equipment; and cutting tools, small tools and machinist supplies.

Wade W. Hampton, Hughes Tool Co., is general chairman, and H. V. Ruth, Ducommon Corporation, general secretary.

Georgia Industrial Output High in 1927

The products of the foundry and machinery manufacturing industries of Georgia ranked second in the total valuation of its output during 1927, exceeded only by the textile manufacturing industry, according to a recent report by the Georgia Agricultural Department issued to compare the value of the agricultural and manufacturing industries in the state during 1927. Textile plants produced nearly $250,000,000 worth of material in 1927, the report shows, while the foundry and machinery industries produced more than $165,000,000, the combined output of these two industries almost equaling the total output of all other industries in the state last year.

Business Items

The Waterbury Fastener Co., Waterbury, Conn., has increased its capital stock from $50,000 to $250,000. The increase is covered by an issue of 200,000 shares of common stock par value $1. There is also 50,000 shares, $1 par, of preferred stock.

Letters of incorporation have been taken out by Welding Research, Inc., 105 W. Monroe St., Chicago. The company will manufacture and deal in apparatus, machinery, tools, instruments and appliances. The incorporators are: Raymond H. Harkrider, Sidney L. Robin and Bernard Baruch.

Articles of incorporation have been issued to the Fraction Metal Corporation, 1716 W. Adams St., Chicago. The company will manufacture and deal in automotive and general machinery and accessories. The incorporators are John B. Devine, C. M. Donigan and Joseph T. Kearns. Capital $50,000.

Golden's Foundry & Machine Co., Columbus, Ga., manufacturers of machinery and mill supplies, announced recently that the company had amended its charter increasing the capital stock from $100,000 to $500,000. It is understood that the company plans an enlargement and improvement program at the Columbus plant.

A consolidation of the Metallgesellschaft and the Metallbank is imminent, according to reports reaching Washington from Frankfort, Germany. In recent years these concerns have been competitors on a large scale throughout the non-ferrous metal field. The fusion, it is expected, will result in greater efficiency and the reduction of operating expenses.

The Warren Iron and Steel Co., Warren, Ohio, manufacturer of alloy steels and agricultural implement disks, is in liquidation. The Industrial Plants Corporation has been ordered to sell at public auction the entire assets of the company, consisting of plant, land and buildings, rolling mills, fabricating departments, and all other machinery and equipment. The sale will be held on Aug. 15, at Warren.

Officers have been elected for the Perfect Circle Co., which recently consolidated with the General Piston Ring Co. of Tipton, Ind. The headquarters of the merged company will be at Hagerstown, Ind. Officers are: Charles N. Teetor, president; Ralph Teetor, first vice-president; Lotnair Teetor, second vice-president; Lewis S. Bowman, secretary, and Ray Teetor, treasurer. Mr. Bowman, the secretary, at present is auditor of state in Indiana.

The St. John Iron Works, of St. John, New Brunswick, Canada, has been purchased by James Playfair and Frank M. Ross, who control the St. John Drydock and Shipbuilding Co., Ltd. The plant will be continued in operation with George H. Waring as manager. Mr. Waring is at present manager of the Union Foundry and Machine Works, Ltd. The latter firm will pass out of existence, as a consequence of the property being expropriated by the St. John Board of Harbor Commissioners to provide for expansion of harbor facilities.

Reorganization of the Century Engineering Corporation, Cedar Rapids, Iowa, manufacturer of the Century fuel oil burner, formerly a $65,000 concern, has been completed with $300,000 capital. T. P. Rogers has been elected president and chairman of the board of directors; Joseph A. Lattner, vice-president; E. J. Lattner, secretary, and Wallace Darling, treasurer. Orders for 2,000 machines are now on file and the plant, which has been occupying one floor of the three-story Lattner building, 215 Fourth Ave., will be extended to occupy the entire building, which was bought by the new company.

The Faries Manufacturing Co., Decatur, Ill., maker of brass, bronze and aluminum castings, automatic screw machines, spinnings and stampings for fixture manufacturers, and a complete line of fixtures, has been reorganized with F. E. Moskovics, president of the Stutz Automobile Co., and Herold V. Strotz, manager of the F. B. Keech Co., Chicago, interested in the company. W. J. Grady remains as president and treasurer of the company; Mr. Moskovics becomes vice-president; W. W. Ellison is secretary and G. S. Foster assistant-secretary-treasurer. The company recently has been manufacturing an oil rectifier which is standard equipment for the Stutz car and lately opened a chomium-plating department, one of the few job plants of its kind in the country.

Personals

NORMAN C. STOW, of Washington, D. C., has been appointed assistant trade commissioner at Bombay, India.

DAVID J. HANNA was recently appointed Detroit district sales manager of the Jessup Steel Co., of Washington, Pa., with office and warehouse at 2208 Fort St., West.

W. T. GREATREX, of Toronto, Ontario, has been elected president and general manager of the Erie Iron Works, Ltd., St. Thomas, Ont., in succession to W. G. Rogers.

BENJAMIN SCHWARTZ, of Baltimore, has been elected director-general of the Scrap Iron & Steel Association, which was recently organized along the lines of industrial institutes for the elimination of unfair and unprofitable practices and for co-operative effort.

J. W. CLIFF has recently joined the MacGregor Valve Co. in St. Louis as production manager. Mr. Cliff has had wide experience in the engineering field, and under his jurisdiction machines are being installed for quantity production of MacGregor rotary valves.

ALEX. L. MILTENBERGER, previously Pacific Coast manager of the Wagner Electric Corporation at San Francisco, is now branch manager of the St. Louis office. Fred Johnson, formerly in charge there, has been transferred to the Los Angeles office as manager.

CLARK H. FOSTER, who has been general manager of the Tolhurst Machine Works of Troy, N. Y., for more than 20 years, has resigned his position. His successor is T. A. Bryson, who for 15 years has been the chief engineer of the plant, in which capacity he has designed many types of centrifugal machines.

WALTER L. RIDROW has been designated by President Coolidge to be examiner in chief and member of the Patent Office Board of Appeals. He succeeds the late Sidney F. Smith. While serving as an examiner in the Patent Office, Mr. Redrow has had experience in those classes of invention involving metallurgy, electro-chemistry and other chemical subjects.

ARTHUR J. TUSCANY was recently chosen secretary-manager of the Gray Iron Institute at a meeting in Cleveland of the executive committee of that organization. For the past six years Mr. Tuscany has been secretary-manager of the Ohio State Foundrymen's Association, and previous to that time he was treasurer, director of purchases, and a member of the board of the Whitney Tractor Co., Cleveland.

R. H. S. ABBOTT, representing Close Bros., Ltd., of London, has arrived in New York with a number of P.I.V. (Positive-Infinite-Variable) gears for inspection. His headquarters are at the Shelton. Among them is the combination of the P.I.V. and the epicycle, which gives a complete mechanical zero and an infinite range. The P.I.V. gear unit is of the positive-drive, variable-speed chain type.

Obituaries

THEODORE KERNER, 73, inventor of time and labor saving devices, died from burns on July 13, in Milwaukee.

SIR JOHN ISAAC THORNYCROFT, founder of the firm of John I. Thornycroft & Co., Ltd., marine engineers and motor vehicle manufacturers, Southampton and Basingstoke, England, died, at the age of 85, on June 28 in Bembridge, Isle of Wight.

MALACHI J. GOOLEY, president of Gooley & Edmund, Inc., Cortland, N. Y., died on July 14 at the age of 63. The firm makes jigs, fixtures and other machine shop products. Mr. Gooley has been prominent in manufacturing circles of Syracuse and Cortland for many years.

RUFUS C. PHILLIPS, secretary of the American Rolling Mill Co. and a brother-in-law of George M. Verity, president of the concern, died at Middletown, Ohio, on July 11, at 63 years of age. Mr. Phillips was prominent in civic and religious affairs as well as in business and industrial circles.

JAMES EDGAR DENTON, professor emeritus of mechanical engineering at Stevens Institute of Technology, died on July 22 at his home in Maplewood, N. J., at the age of 73. He became an instructor at the college shortly after his graduation from there in 1875, and in 1898 he became professor of mechanical engineering.

FREDERICK W. GRIFFITH, associated with the mechanical packing industry since its infancy, died on July 11 at the age of 70 at his home in Pasadena, Cal. At the time of his death he was president, treasurer and member of the board of directors of the Garlock Packing Co., of Palmyra, N. Y., and was one of its founders.

FRANK H. HAYES, president of the Hayes' Pump & Machinery Co., Boston, Mass., died July 14 at Cambridge. Mr. Hayes was 79 years old and a well known engineer. Forty-five years ago he started his connection with the pump and machinery industry with the Dean Steam Pump Co. In 1900 he organized and in 1923 incorporated the Hayes company.

Forthcoming Meetings

Canada's Steel and Power Show. Second annual show to be held at the University of Toronto Arena, Sept. 4-7. Secretary, Campbell Bradshaw, 24 Front St., Toronto, Ontario.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

Machine Shop Practice Division, American Society of Mechanical Engineers. National meeting, Cincinnati, Sept. 24-26. Part of sessions to be on steamer "Cincinnati." Secretary, Carlos de Zafra, 29 W. 39th St., New York City.

National Safety Council. Seventeenth annual safety congress will be held in New York, October 1-5. Idabelle Stevenson, executive secretary, 1 Park Ave., New York.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Welding Society. Fall meeting and exposition, Exhibition Hall of Commercial Museum, Philadelphia, Pa., Oct. 8-12, in conjunction with "National Metals Exposition" of the American Society for Steel Treating. Miss M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals, Division of American Institute of Mining and Metallurgical Engineers. Annual fall meeting during National Metal Week, Oct. 8-12, Benjamin Franklin Hotel, Philadelphia. W. M. Corse, secretary, 810 18th St., N. W., Washington, D. C.

American Gear Manufacturers Association. Semi-annual meeting, Statler Hotel, Buffalo, N. Y., Oct. 11-13. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

American Management Association. Autumn convention, Palmer House, Chicago, Nov. 13-15. W. J. Donald, managing director, 20 Vesey St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

WITH pig-iron shipments active and steel consumption unusually heavy for this time of the year, fourth-quarter prices on the principal hot-rolled products have been advanced this week to $1.90@$2 per 100 lb., Pittsburgh, against the current rate of $1.85. Present prices on bars, shapes and plates are about 10c. per 100 lb. above those of a year ago. Steel mill operations are at approximately 69½ per cent of capacity as compared with 71 per cent a week ago and 72 per cent at this time last year. Buying is most active in steel pipe and rails. The non-ferrous metals are moving slowly; solder declined ½c. per lb. at New York warehouses; scrap tends downward.

(*All prices as of July* 20, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$19.69
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4 50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quorations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2 10@2.20	3.50	3.25	3.90*
No. 12	2.15@2.25	3.55	3.30	3.95*
No. 14	2.25@2.30	3.60	3.35	4.00*
No. 16	2.35@2.40	3.70	3.45	4.10*
Black				
Nos. 18 to 20	2.50@2.60	3.75	3.45	4.00
No. 22	2.65@2 75	3.90	3.60	4.15
No. 24	2.70@2.80	3.95	3.65	4.20
No. 26	2.80@2.90	4.05	3.75	4.30
No. 28	2.95@3.05	4.20	3.90	4.45
Galvanized				
No. 10	2 95@3.05	4.10	3.70	4.25
Nos. 12 to 14	3 05@3.15	4.20	3.80	4.35
No. 16	3 15@3.25	4.30	3.90	4.45
No. 18	3 30@3.40	4.45	4.05	4.60
No. 20	3.45@3.55	4.60	4.25	4.75
No. 22	3 50@3.60	4.65	4.30	4.80
No. 24	3.65@3.75	4.80	4.40	4.95
No. 26	3 90@4.00	5.05	4.65	5.20
No. 28	4.15@4.25	5.30	4.90	5.45

*250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., steel, butt welded.	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., steel, lap welded.	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—⅛	¼	⅜	½	⅝	¾	⅞
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ⅜ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.50
Tin, straits, pigs, New York			49.50
Lead, pigs, E. St. Louis	6.00	New York	7.75
Zinc, slabs, E. St. Louis	6.20	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.00	14.25
Copper sheets, base	23.50	23.50	23.50
Copper wire, base	20.12½	19.62½	16.75*
Copper bars, base	22.00	22.00	22.50
Copper tubing, base	25.00	25.00	25.00
Brass sheets, high, base	19.25	19.25	19.25
Brass tubing, high, base	24.12½	24.12½	24.12½
Brass rods, high, base	17.00	17.00	17.00
Brass wire, high, base	19.75	19.75	19.75

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.00	9.61
Solder (strictly).....	31.00	32.50	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade.....			66.00
Commercial genuine, intermediate grade.....			53.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.25
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots..... 35.00	Electrolytic.. 37.00	Shot.....	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled rods, Grade "A" (base).....	45.00
Cold drawn rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base)..	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f. o. b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	12.75 @13.00	12.00	11.75@12.25
Copper, heavy, and wire..	12.00 @12.75	11.25	11.25@11.75
Copper, light, and bottoms	10.62½@11.12½	9.75	10.00@10.50
Heavy lead.....	4.87½@ 5.12½	5.25	4.50@ 5.00
Tea lead.....	3.50 @ 3.75	3.75	3.50@ 4.00
Brass, heavy, yellow.....	7.12½@ 7.37½	7.75	7.25@ 7.75
Brass, heavy, red.....	10.00 @10 50	10.00	9.50@ 9.75
Brass, light.....	5.50 @ 6.00	6.25	6.25@ 6.75
No. 1 yellow rod turnings.	8.00 @ 8.50	7.75	7.50@ 8.00
Zinc.....	3.25 @ 3.50	3.25	2.87½@3.37½

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC,	14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.15½	38.00 per M	.17
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.11	.105	.108
Cutting oil, about 25% lard, in 5 gal. cans, per gal....	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade.....	30–10%	35%	35%
Heavy grade.....	25– 5%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb....	$0.0325	$0.0325	$0.0324
Cold drawn shafting....	per lb....	.034	.034	.04
Brass rods.....	per lb....	.17	.17	.1525
Solder (½ and ½).....	per lb....	.31	.3275	.39
Cotton waste, white....	per lb....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.10	3.10	3.10
Lard cutting oil.....	per gal...	.65	.65	.65
Machine oil.....	per gal...	.30	.30	.27
Belting, leather, medium.....	off list....	30–10%	31½%	40–5%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper.....	$5.40	$4.95	$5.13
*Emery paper.....	10.71	9.15	10.71
†Emery cloth.....	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	1.29	1.27	1.32
Cloth.....	3.10	3.05	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton..	Connellsville,		2.25@2.50
Coke, prompt foundry, per net ton ..	Connellsville,		3.25@3.75
White lead, dry or in oil...	100 lb. kegs....	New York,	13.25
Red lead, dry.....	100 lb. kegs....	New York,	13.25
Red lead, in oil.....	100 lb. kegs....	New York,	14.75

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1⅛ and 1¼ in. dia.....	35%
Carriage bolts:	
Up to ¾ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ¾ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Boston — Packard Motor Car Co., East Grand Blvd., Detroit, Mich.—machine shop equipment for proposed 1 and 2 story factory and auto service building here. Estimated cost $70,000.

Mass., East Boston (Boston P. O.) — School House Dept., City Hall, Boston—woodworking machinery for U. S. Grant School, on Paris here.

Mich., Detroit — Commonwealth Brass Corp., 5781 Commonwealth Ave.—milling machine and equipment.

Mich., Detroit—Graham Paige Motor Car Co., 8505 West Warren Ave.—miscellaneous equipment for assembling automobiles for proposed 1 story factory.

Mich., Detroit—Turner Messenger Mfg. Co., 1059 Beaufait St.—one screw machine.

Mich., Lansing—Motor Wheel Corp., 701 East Saginaw St.—presses and equipment for the manufacture of steel parts for wheels for proposed 1 story, 74 x 460 ft. plant.

O., Marysville — Federal Brass & Mfg. Co., H. T. Anderson, Secy. (metal specialties)—machinery and equipment for proposed new foundry.

Ont., Sarnia — Laidlaw Belton Lumber Mills—prices and catalogs on complete equipment for mill recently destroyed by fire. Loss $150,000.

N. Z., Auckland—Dept. of Public Works, Supplies and Tenders—will receive bids until Sept. 11 for two 10 cwt. electric traveling indoor cranes complete.

Opportunities for Future Business

Calif., Los Angeles—Kittenger Co., Buffalo, N. Y., manufacturers of furniture, plans the construction of a factory, etc. on Industrial Ave. here. Estimated cost $2,000,000.

Calif., San Francisco—W. S. Ray Mfg. Co., Bosworth and Milton Sts., manufacturers of Ray fuel oil burners, is having plans prepared for a 1 and 2 story addition to factory. Estimated cost $70,000. Irvine & Ebbets, Call Bldg., Archts.

Conn., Hartford—Hartford Gas Light Co., 565 Main St., had plans prepared for a 1 story machine equipment service building on Prospect St. Estimated cost $60,000. Private plans.

Ill., Chicago—A. S. Alschuler Inc., 28 East Jackson Blvd., Archt., is receiving bids for a 19 story, 120 x 172 ft. garage, etc. at Wabash Ave. and Harrison St. for H. Rubloff, 10 South La Salle St. Estimated cost $2,000,000. Noted Mar. 22.

Ill., East St. Louis—The Parks Airlines Inc., Missouri Theatre Bldg., St. Louis, is having preliminary plans prepared for a 1 story, 200 x 850 ft. airplane factory. Estimated cost $500,000. Architect and engineer not selected.

Ind., Alexandria—Aladdin Mfg. Co., 601 West Lake St., Chicago, Ill., is having plans prepared for the construction of a machine shop, etc. here.

Ind., Fort Wayne—National Mill Supply Co., awarded contract for a factory at 207 East Columbia St. Estimated cost $40,000.

Ind., Indianapolis—Federal Foundry Co., 502 South Harris St., will soon award contract for the construction of a foundry including 50 x 56 ft. carpenter shop, 50 x 50 ft. brass foundry, 40 x 80 ft. addition to core room, 40 x 50 ft. pattern shop, etc. Estimated cost $225,000. Carter-Richards Co., Engineers Bldg., Cleveland, O., Archt. and Engr.

Ia., Waterloo—John Deere Tractor Co., awarded contracts for a 6 story, 100 x 260 ft. machine shop to John G. Miller & Sons Construction Co., 616 Caward Bldg. and 1 story, 120 x 400 ft. mill building to J. Oleson, & Sons Construction Co., 1522 Lafayette St. at Commercial and Mills Sts. Estimated total cost $376,000. Noted June 28.

Md., Baltimore—Central Foundry Co., Dundalk, plans the construction of a 1 story addition to plant for the manufacture of cast iron and universal pipe and fittings, general castings, etc.

Md., Baltimore—Union Bros., 37 West Cross St., manufacturers of furniture, will soon award contract for a 1 story, 52 x 300 ft. factory at Beason, Clement, Decatur and Lowman Sts. B. Frank, 517 Charles St., Archt. Noted May 31.

Mass., Chelsea (Boston P.O.)—Beaudette Mfg. Co., Crescent Ave., manufacturers of loud speakers, is receiving bids for a 2 story addition to factory. Schein & Levine, 448 Broadway, Archts. Noted July 5.

Mich., Detroit—Lane, Davenport & Peterson, 1007 Charlevoit Bldg., archts., will receive bids about July 24 for a 2 story, 60 x 60 and 60 x 68 ft. factory on Woodrow Wilson Ave. for Gorham Tool Co., 2206 12th St.

Mich., Saginaw—Chevrolet Motor Car Co., General Motors Bldg., Detroit, awarded contract for a 1 and 2 story foundry including 2 story, 100 x 180 ft. pattern shop, etc. here. Estimated cost $2,000,000.

Mo., St. Louis—Cruendler Patent Crusher & Pulverizer Co., 320 North 4th St., awarded contract for a 1 and 2 story, 98 x 162 ft. factory at 2915 North Market St. Estimated cost $40,000.

Mo., St. Louis—Universal Cutter Co., 4567 Scott Ave., awarded contract for a 2 story, 55 x 115 and 55 x 105 ft. factory for the manufacture of electric cloth cutting machines at Skinker and Clemens Sts. Estimated cost $60,000. Noted June 14.

Neb., Gering—Union Pacific R.R., Union Pacific Bldg., Omaha, awarded contract for the construction of a group of terminal buildings including roundhouse, 25 x 74 ft. machine shop, etc. here. G. J. Adamson, Ch. Engr. Noted June 14.

N. J., Hackensack—Sproat & Dunn, 211 State St., is receiving bids for a 2 story, 110 x 125 ft. addition to garage on State St. Estimated cost $150,000. B. S. Newman, 173 Main St., Archt.

N. J., Irvington—American Metal Moulding Co., 46 Cort St., awarded contract for a 1 story, 55 x 200 ft. pipe plant. Estimated cost $40,000. Enbro Corp., 111 Academy St., Newark, Archt.

N. J., Lodi—Metalkloth Co., c/o J. H. Lisbon, 238 Main St., Hackensack, Archt., is receiving bids for a 1 story addition to factory on Garibaldi Ave. here. Estimated cost $40,000.

N. J., Newark—Sonatron Tube Co., 88 8th Ave., Newark, is receiving bids for a 4 story 45 x 120 ft. factory at 57-59 State St. Estimated cost $60,000. Siegler & Greenberg, 164 Market St., Archts.

N. Y., Binghamton—Fairbanks Valve Co., Lafayette & Broome Sts., New York, awarded contract for the construction of a factory. Estimated cost $125,000. Noted Apr. 5.

N. Y., Brooklyn—Brooklyn Parking Terminal Inc., J. V. Coyle, Pres., 250 Park Ave., New York, had plans prepared for a 6 story, 101 x 220 ft. garage at De Kalb and Navy Sts. Estimated cost $300,000. J. B. Peterkin, 285 Madison Ave., Archt.

N. Y., Brooklyn—Decorated Metal Mfg. Co., E. H. Thatcher, 196 Degraw St., awarded contract for a 6 story factory and warehouse. Estimated cost $100,000. Noted Feb. 9.

N. Y., Brooklyn—P. D. B. Building Corp., P. Butterman, Pres., 475 Crown St., had plans prepared for an 82 x 211 ft. garage at East New York Ave. and Herzl St. Estimated cost $250,000. Farber & Kalkin, 1746 Pitkin Ave., Archts.

N. Y., Brooklyn—Realty Associates, W. Greve, Pres., 162 Remsen St., had plans prepared for a 3 story, 108 x 197 ft. garage at 130 Western Parkway. Estimated cost $350,000. B. Driesler Jr., 153 Remsen St., Archt.

N. Y., New York—Weprin & Glaso Building Corp., H. Weprin, Pres., 145 West 27th St., plans the construction of a 1 and 2 story, 100 x 200 ft. garage at Longfellow and Seneca Sts. Estimated cost $50,000. C. N. Shinston, 2 Columbus Circle, Archt.

N. Y., New York—Woodlawn Cemetary, 20 East 23rd St., awarded contract for a 2 story, 62 x 140 ft., garage and shop at Katonah and 233rd Sts. Estimated cost $100,000. Noted July 19.

O., Canton—Leonard Agency Co., G. D. Harter Bank Bldg., awarded contract for a 1 story, 70 x 240 ft. garage at 9th St. and Cleveland Ave. N.W. Estimated cost $40,000. Noted June 21.

O., Cleveland—A. Brudno, 1281 West 9th St., plans a 4 story, 42 x 90 ft. repair and service garage. Estimated cost $150,000. Architect not selected.

O., Cleveland—Federal Foundry & Supply Co., L. H. Hart, Secy. and Mgr., 2639 East 79th St., awarded contract for a 1 story, 90 x 260 ft. factory on East 71st St. Estimated cost $125,000. Noted July 5.

O., Cleveland—The McKinney Tool & Mfg. Co., E. W. McKinney, Pres., Arabella Rd. and Roseland Ave., is receiving bids for a 1 story, 60 x 60 ft. addition to factory on Roseland Ave. Estimated cost $40,000. E. G. Hoefler, B. F. Keith Bldg., Archt. Noted July 19.

O., Cleveland—Thompson Products Co., C. W. Miller, V. Pres. and Gen. Mgr., 2196 Clarkwood Rd., manufacturers of automobile accessories, plans addition to factory. Estimated cost $125,000. Roberts-Wright Co., Swetland Bldg., Archts.

O., Cleveland—U. S. Aluminum Co., c/o R. C. Wilson, 2210 Harvard Ave. had plans prepared for a 5 story, 68 x 138 ft. warehouse and pattern shop, etc. Estimated cost $150,000. Private plans.

Pa., Philadelphia—Nevin Bus System, 159 Remsen St., Brooklyn, N. Y., plans the construction of a 7 story bus terminal and garage at 12th and Commerce Sts. Estimated cost $600,000. W. F. B. Koelle, 112 South 16th St., Philadelphia, Pa. Archt.

Pa., Pittsburgh—Pennsylvania Transfer Co., of Pittsburgh, 298 Duquesne Way awarded contract for a 1 and 2 story, 100 x 200 ft. garage on Main St. Estimated cost $150,000. J. F. McWilliams, 107 North Hilgard Ave.

Tenn., Nashville—Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., plans the construction of a new plant including pipe cutting and pipe threading departments, etc. at Seventeenth Ave. and Church St. here.

Tex., San Antonio — Syndicate, c/o G. Medliff, San Antonio Bldg., Material Co., is having plans prepared for a 3 story, 108 x 126 ft. garage at Crockett and Bonham Sts. Estimated cost $250,000. Phelps & DeWees, c/o Gunter Bldg., Archts.

Wis., Appleton—Appleton Machine Co., 618 Oneida St., awarded contract for a 1 story, 80 x 100 ft. addition to foundry. Noted June 28.

Ont., Sudbury—International Nickel Co., 67 Wall St., New York, awarded contract for the construction of a nickel and copper smelter plant at Copper Cliff. Estimated cost $1,000,000.